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THE MARINE ENGINEER;

A MONTHLY JOURNAL OF

MARINE ENGINEERING, SHIPBUILDING,

AND

STEAM NAVIGATION.

EDITED BY WILLIAM GEORGE NEAL, ASSOC. I.N.A.

Vol. X.—From April, 1888, to March, 1889.

London:
OFFICE FOR ADVERTISEMENTS AND PUBLICATION, 3, AMEN CORNER,
PATERNOSTER ROW, E.C.

1889.

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Printed for the Proprietor by PERRY, GARDNER & Co., 21 & 22, Cursitor Street, and Published at the Office, 3, Amen Corner, Paternoster Row, in the Parish of Christ Church, in the City of London.—*March 1st*, 1889.

The Marine Engineer.

LONDON, APRIL 1, 1888.

EDITORIAL NOTES.

THE development of the principles of construction of modern ironclads and of weapons of offence to be used for their destruction, continues to occupy a very large share of attention amongst naval architects. There is perhaps great excuse for the interest in this particular line of study; since our actual existence as a nation may some day depend upon our capability to maintain our supremacy at sea as heretofore. As so little is known by practical experience as to the behaviour in actual warfare of our modern ironclads, the whole subject is still involved in the mist of untried speculation. At the 29th Session of the Institution of Naval Architects some interesting suggestions on this subject were communicated by Captain C. C. Penrose Fitzgerald, R.N., in which he compares the comparative chances of one of our modern ironclads being sunk either by the infliction of a number of small wounds in the region of the water-line, or by torpedo attack, a blow from a ram, or by injury produced by the enormous projectiles of modern warfare. The "one blow theory" of destruction in a naval engagement is very fascinating to theorisers, and would be very effective in determining an engagement, were it possible to realise frequently that Captain Fitzgerald (on the principle that only one bullet in a thousand in a battle kills its man) suggests that naval engagements are also likely to comprise so many misses, that a large number of small wounds are likely eventually to be the immediate cause in deciding the battle. He thinks that under this consideration vessels designed essentially to resist destruction by any single wound may find themselves at a disadvantage under the theory of small continuous wounds eventually determining the battle. Vessels constructed on the theory of the greatest immunity from destruction under the one blow theory, and to secure other qualities, such as speed and coal endurance, have been left with large areas below water-line, unprotected by armour, or any other material which would prevent the inflow of water following the penetration of even the smallest projectiles. As naval gunnery has latterly been rapidly developed in the direction of quick-firing guns in all sizes from 3 to 36 pounders, this new danger to unprotected water-lines is becoming a very serious one. The French seem to be paying particular attention to the protection of water-lines by a light water-excluding material, and it is reported that they have adopted cellulose for such a purpose in case of the large and powerful cruiser *Dupuy-de-Lome*, which is to be very heavily armed, and will be practically unsinkable by the use of this material. Indiarubber in sheet is known to have many properties extremely useful for this purpose of preventing influx of water after penetration. Captain Fitzgerald reports that he carried out experiments as to the penetrative effect of the projectile from a 6-pounder through 1½ inch plate of indiarubber; the diameter of the projectile was 2·2 inches and the indiarubber was resting against a steel plate representing the water-line of the *Collingwood*. The hole made in the steel plate was about three times the size of the transverse area of the projectile and the indiarubber covering was found to close without leaving any hole through which the water could have followed. Experiments afterwards conducted by the Admiralty as to indarubber plates, fixed in cofferdams, were pronounced to be a failure, as they were easily torn to pieces by shell fire. The author considers that the experiments so carried out were by no means sufficiently exhaustive to test the value of indiarubber under all positions against normal shell fire. It is obvious, if the shell were to burst in the material of a soft nature, such as indiarubber, it would certainly be torn to pieces, but that does not decide the question, whether the indiarubber might not be so placed as to allow the shell to pass before bursting and then to close the hole of transit. It is yet an open question as to what material would best fulfil such a purpose, whether cellulose, indiarubber, cotton, or the material called woodite, of which a good deal was heard some time ago, but of which we have heard nothing lately. The object sought by Captain Fitzgerald is to impress upon naval experts, through the Institution of Naval Architects, the importance of further experiments in the direction suggested, in which very little, if anything, has been done up to the present.

THE Americans have also been considerably puzzled as to the best designs upon which to build the armoured Navy which they now propose to set in hand. They have made a commencement some years ago by buying designs from private firms in this country, as W. John, Esq., Member of Council, tells us in his paper, communicated to the Institution of Naval Architects. Not satisfied with this supply of designs, the present Secretary of the United States Navy has asked by advertisement in the open market for competitive designs for two types of

ship, one a battle ship and the other an armoured cruiser. As a prize of 15,000 dollars was offered for the most successful design, Mr. John thought it worth his while to enter into the competition, and one of them, that of the battle-ship, was awarded the prize mentioned. The vessel or vessels from this design are to be built in the States, but the Naval Construction and Armaments Company, Limited, which have taken over the business of the Barrow Shipbuilding Company, of which Mr. John was general manager, are to make the working drawings. The particulars of this ship, which has thus being chosen by public competition, should be of interest. She is of 6,300 tons displacement with a maximum draught of 23 ft. of water. Her extreme breadth is 64 ft. She is to be armed with two heavy guns only, of 12-in. bore, each weighing 46½ tons. The guns admit of heavy bow and stern fire, and there are a number of 6-in. guns and a powerful secondary battery of quick-firing guns with torpedo tubes. The cruiser designed by Mr. John had its armament arrayed on a broadside consisting of four 10-in. guns and six 6-in. guns. Mr. John is a believer in a water-line belt in preference to internal sloping protection. He believes that given a certain depth of belt above and below the water line, vertical armour is preferable to internal sloping armour, both for broadside fighting and for a running fight, as in one case the shot and shell will probably glance from the vertical armour, while the internal armour will give a background for bursting shell against, which might tear out yards of a thin side in the region of the water line, not only affecting stability, but also speed. The dimensions of build adopted by Mr. John from the vessel in question was 2 ft. above water and 4 ft. 6 in. below. The stipulations of the United States Naval Secretary required no less than 24 Hotchkiss and Gatling guns for the secondary battery. The whole is to be built of mild steel and to have twin-screws, and the design provides for a steel-faced armour belt 12 in. thick, extending beyond the engines, boilers, and all magazines, and ending in an armoured bulkhead. Steam and hand-steering gear is fitted below a protective deck, and steering connections are made with them from the conning tower, after-wheelhouse, and flying bridge. The communications from the conning tower and the hoists from the magazines are both protected. Provision is made to carry two second-class torpedo boats and a sufficient number of other boats to carry the crew, including one steam pinnace and one steam cutter, each mounting a 3-pounder Hotchkiss rapid-firing gun. The vessel is to have a speed in fighting trim of 17 knots. Mr. John considers this vessel especially suitable for bow or stern fighting in case of meeting a hostile enemy, or in case of escaping from an enemy too powerful to be engaged. The turrets carrying the two heavy guns are in échelon, so as to be able to maintain both stern and bow fire, and yet heavy broadside concentration, and the vessel undoubtedly appears from this description to be a very awkward customer for any enemy to meet.

Captain Hubert Grenfell, R.N., in his interesting paper upon the development of modern weapons, enters at length into the question as to how a ship should be fought. It is suggested that the great change that has taken place in the weight and size of modern ordnance, and in the introduction of entirely new weapons of offence, such as the torpedo and the ram, has so altered the known conditions of naval warfare that naval officers must be considerably at a loss when asked to determine how a ship may best be fought. There appears to be no recognised instructions in the navy as to the best method for the conduct of a ship in separate, or of a squadron in combined, action, based upon the conclusion as to the respective merits of the various weapons. It is suggested that such instructions would be highly valuable to the present naval commander. As the heaviest weapons now actually on board ship are capable of piercing some 3 ft. of iron plate, the superiority of the most powerful guns to the stoutest defence appears for the moment to be undeniable. It is yet difficult to see what part the torpedo may play as an armament for our cruisers. Mr. White considers that in view of the impossibility of foretelling what demands may be made upon a war vessel, the association of all three forms of attack, the gun, ram, and torpedo, in all vessels of considerable size, is the only safe policy. The *Scout*, however, which was designed for 11 torpedo tubes, has only been completed with seven. In comparison with gun fire, the range of the torpedo is very limited, and has all the elements of uncertainty. The provision also of torpedoes as ammunition, since each is so bulky, will offer considerable difficulty. Captain Grenfell thinks it is high time that some definite respective value for the gun, ram, and torpedo should be fixed by experts in the subject, and we gather from his criticisms that he thinks that the danger of torpedo attack is at present very much exaggerated, as compared with the effect of gun fire, owing to the want of experience which at present exists in the former, and he foreshadows that a considerable change of opinion with regard to the excessive value either of torpedo armament or torpedo flotillas, as a means of offence or defence, is taking place and still in progress.

THE position of our naval reserve in case of sudden war seems to be as yet far from satisfactory, particularly in the number of officers retained for the large number of seamen included on our reserve list, amounting, we believe, to nearly 18,000 men. The number of officers does not seem to exceed 141, and they are necessarily scattered all over the world in the various vessels of our mercantile marine. Amongst these officers there are only three engineers, and seeing the important functions which the engineer may be called upon to discharge in the naval warfare of the future, this appears an absurd provision. We see that the number on the list of requirements should be 150, but it is evident that the proper inducement should be offered to all classes of officers to induce them to place their names upon this list. We see that Lieut. W. C. Crutchley, of the Royal Naval Reserve, has given some admirable details on the subject, and he very properly points out that even were the whole required list of officers and seamen obtained, they would still be in an entirely useless position at the outbreak of a sudden war, from the men and officers being scattered all over the world and unknown to each other and probably not in the same ship. They would thus be useless until called home to a central depôt for arming and redistribution. It is suggested by Lieut. Crutchley that if a sufficient number of ships were selected from the best known liners, arrangements might be made that they should be manned by a sufficient crew of men and officers at call, in case of sudden war, and that it would not occupy much space for the vessels to carry a sufficient armament closely stowed and a certain quantity of ammunition. This would enable us at the first outbreak of war to furnish swift armed cruisers upon all our main lines of communication, which would be a very valuable point of advantage for ourselves, as our commerce would probably be merely menaced by unarmoured cruisers of an enemy. Lieut. Crutchley also suggests that certain points might be indicated at which all our main liners should constantly pass, so that any announcement of a sudden war might be communicated as rapidly as possible to our vessels on the high seas. A general system of warning to be given to our trading vessels appears to be a most important provision to prevent destruction of property on a sudden outbreak of war to an extent that can hardly be imagined. By the Declaration of Paris it might be considered that it is at present illegal for merchantmen to be armed, and it would be well that such a point should be rectified before immediate urgency should make the precaution too late. It has been thought by good authorities that a large proportion of our merchant vessels, if allowed to arm themselves, might very well protect themselves against the class of ships that would attack them. The coaling of men-of-war is also a most important matter. This, Lieut. Crutchley believes, might best be done by bags, each holding 2 cwt., transferred from a store ship by large boats, such as the Berthon boats, which it is said would be quite possible in a very rough sea. Lord Charles Beresford, who is looked upon as one of the most energetic naval organisers, seems to have fully concurred in the fact that attention would be well bestowed by the Admiralty upon all the above points in view of any sudden emergency.

INSTITUTION OF NAVAL ARCHITECTS.

THE annual meetings of the Institution of Naval Architects took place on March 21st, 22nd, and 23rd, in the hall of the Society of Arts, Adelphi, under the presidency of the Earl of Ravensworth. There was a large company present, including the representatives of the Royal Navy and mercantile marine, as well as naval architects of both the national and private shipbuilding yards. Among those present were Lord Brassey, Admiral Sir Spencer Robinson, Admiral Sir John Hay, Mr. W. H. White (Director of Naval Construction), Sir N. Barnaby, Admiral Colomb, Admiral De Horsey, Admiral Fremantle, Captain Fitzgerald, R.N., &c. The secretary, Mr. George Holmes, read the annual report, which stated that, owing to the increase in the number of members of the Institution, due no doubt, in great measure, to the holding of summer meetings at Liverpool, Newcastle-on-Tyne, and Sunderland, the receipts continue to increase and the finances are in a satisfactory condition. A most cordial invitation to hold a summer meeting this year at Glasgow has been received from the President of the Institution of Engineers and Shipbuilders in Scotland, and from the directors of the Clyde Steam Shipowners' Association, and of the Sailing Ship Association. The last visit to the Clyde took place in the year 1877, and the prosperity of the Institution may be said to have dated from that meeting. The Council have accepted the invitation with great pleasure, and the meetings, of which full particulars will shortly be announced, will take place towards the end of July. The Council having received information that an attempt was being made to induce the Science and Art Department to remove and partly break up the Museum of Naval and Marine Engineering models at South Kensington, appointed a deputation to wait upon the Lord President, to represent that the Museum, in its present central and accessible situation, was of great use both to the profession and for the furtherance of technical education. The deputation was most favourably received by the Lord President, who assured the members that the Government would give every consideration to their representations, that the Department had no wish to remove the collection, and that its hands would be strengthened by the action taken by the Institution.

The PRESIDENT, in moving the adoption of the report, delivered the following address:—

Gentlemen,—It now becomes my duty to rise and move, in accordance with precedent, the adoption of the report which has been read to you by the secretary; and I claim your indulgence for a short time, as I have some remarks to offer. In the first place it is always a painful duty that falls to the President of this association to notice at least, with all the respect that is due, the losses that we have sustained in the course of the year. We have lost Admiral Key, an officer of great distinction, who had served his country at sea and also in the councils of the Admiralty with very great distinction, and I believe with great advantage to the country. We have lost also a very old member (I believe he was), Mr. Robinson, who had for a long and useful

life been connected with the Government Dockyards. I am sure I am only doing a sad but a very proper duty in noticing that, and expressing on behalf of the whole of our members our sympathy with their respective families in the loss they have sustained.

Now, gentlemen, I pass from a sad to a very joyful subject, and that is the invitation that we have received from our friends in Glasgow to hold our summer meeting there. I would call your attention to a very interesting historical fact; it is known no doubt to many of you, but it may not be within the recollection of some, and particularly some of our younger members. This year is the centenary of steam navigation. It was in October, 1788, that the first steamer was launched and put into motion. That was a very remarkable boat. She was designed by a Scotch gentleman, a Scotch laird, Mr. Millar, of Dalswinton, and she was engined by a Scotch engineer of the name of Symington, and she was launched on Dalswinton Loch, in Dumfriesshire, in October, 1788. That is a very interesting historical fact, and I think you will admit with me that this centenary is a most appropriate occasion for our friends in Scotland to have availed themselves of to invite us to hold our summer meeting, in what I may call the heart and the centre of Scotch industry and enterprise, viz., Glasgow. I do not know any place where we are more likely to be well received. In fact, I have known many of our Glasgow friends so well that I can venture upon the prophecy that we shall be most kindly and hospitably received; that we shall have the opportunity of visiting some of the grandest works connected with navigation that the world probably can present; and, to turn to the recreative part of the question, which is always some consideration in our minds, I do not know in Nature a spot which Nature has so adorned as the Firth of Clyde, and I do not know a town in which hospitality and kindness are so largely extended as Glasgow. I am quite sure that we shall all derive both instruction and pleasure from our summer meeting there, and I return, on behalf of all members of this Association, our unfeigned thanks to our Scotch friends for that kind invitation; and I only trust that large numbers of our members may find time and opportunity to avail themselves of the invitation.

Now, gentlemen, I have a few remarks to make upon one or two of the leading events of the past year. Apart from the happy and most successful celebration of our beloved Queen's Jubilee, I do not know that the past year presents many features of very special interest; but probably, in a commercial sense, the last few weeks of it may be regarded with considerable interest, because they undoubtedly shewed symptoms of moderate improvement in trade. And I am also happy to notice that of all our national industries there is none which is shewing at the present time perhaps greater activity than is that of shipbuilding. It is not what we should wish to see it, but still there is considerable activity going on in many, I hope most, of our shipbuilding yards, and those various trades which are connected with the great shipbuilding industry. I have used intentionally the word *moderate* improvement, because trade is at present very far from what we should wish to see it. And at the same time there is no doubt that in the minds of some wise and far-seeing men, this renewed activity in our shipbuilding yards is regarded with some little apprehension in regard to the future and its effect upon freights. Possibly those apprehensions may be in part justified by their recollection of the events of the last three or four years; because I think there can be no doubt whatever that the inflation of the industry some three or four years ago and the rush to build additional tonnage considerably added to the gravity of the depression when it came upon the shipping industry. Therefore it is not at all unlikely that persons should entertain apprehensions of anything like an undue increase of tonnage. I hope that this may not be the case; but undoubtedly those apprehensions do exist in some quarters, and I only hope they may not be realized, but that trade may increase to an extent to justify the increase of tonnage which is undoubtedly indicated by the orders that are now being executed in many of the yards. But, gentlemen, there is one thing that I am quite certain about. It is a fact that impresses itself more and more upon my mind, and it is no use blinking the fact. I say that trade has not reached anything approaching the proportions that are and have been for such a long period so anxiously longed for; and unless and until peace is assured I think it is a vain thing to imagine that trade can or will reach a point of general prosperity. What we hope and wish for is activity in trade all over the world, not only confined to our own country; and until peace is assured I say it is a vain hope that trade will show the general improvement which we all hope for.

Now, the next point that I wish to notice is not entirely unconnected with the last remarks that I have made. There is one question which to my mind, as one who has been engaged in public life now for a great number of years, is beyond all others the most important to Englishmen to consider: and that question has received a very great impulse during the past year. It is nothing less than the question of our national defences. Now, gentlemen, I have said that it has received a considerable impulse in the course of the last year, and I date the commencement of the impulse—I am speaking, of course, now only of the last year—it received its chief impulse I will venture to say in two most remarkable speeches, which were delivered in my hearing by no less a man than His Royal Highness the Commander-in-Chief, when he did us the honour to come down to Newcastle and open our Exhibition. They were addressed in statesmanlike terms of eminent power and ability and eloquence, and they were addressed to a great commercial community, and they had a very deep effect upon the mind of every man who heard them. Those remarks were suggested by long thought, and all the military and strategic experience which a long life in the service of his country has given to our respected Commander-in-Chief. Well, the next impulse that was given to this question was derived I think from a most able speech delivered by my Lord Armstrong, on the Address to the Crown at the opening of Parliament this year. I have no doubt that speech has been read and re-read all over the country: and it contains warnings which we should be all of us I think loth to neglect. The third impulse was given by the Report of a Committee appointed by the present Secretary of State for War, and I wish particularly to call your attention to the Report, because it is of extreme value and importance. The Committee was appointed by the Secretary of State for War, for the purpose of considering the plans proposed for the defence of our military and mercantile ports. "Mercantile ports" is the point upon which I wish to lay some stress in your presence. That Committee consisted of nine members; only two of them belonged to the services at all, one General, and one Admiral: consequently the Report and recommendations of the Committee cannot be said to be embued with anything like professional prejudice in favour of a large expenditure for these purposes; the other seven members were sober members of Parliament, most of them, all civilians, and therefore the last men to recommend anything like unnecessary expenditure of public funds. Now, I wish just to point out to you in a few sentences the gist of the Report. The Committee first of all tell the country that the witnesses whom they examined (and their witnesses were the highest authorities, the most instructed experts that this country can produce) were unanimous in pointing out the weakness of our present position, and "in urging the imperative necessity of strengthening and adding to the existing defences of the country." Those are the words of their witnesses; then the Committee themselves end by pointing out "the paramount importance of carrying out without delay the most urgent works." Well, the last impulse given to this great national movement in which we must all take an interest was given by the vote proposed for this purpose. Now, of course, this is not the place to canvas that vote or the amount of it. To my mind (I speak independently), it appears to me exceedingly small for the objects in view. It amounts in the whole to three millions of money, which are to be spent in three years. But what I wish particularly to note is this: that the occasion is "urgent"; and, though no doubt, small beginnings make great endings, it is the urgency of adequately protecting our commercial ports that weighs so deeply upon my mind. And, when I consider the importance of adequately defending those ports, it appears to me that steps should be taken at once and to any extent necessary for affording that defence. Now, gentlemen, I will not dwell much longer on this question of national defence; but it is so important, because I see before me here the representatives of the shipping interest—the shipbuilders, the marine engineers of England; and I say that this is a question that affects their interest almost more deeply than that of any other class that I could name; and I should feel that I was not doing a public duty if I did not call your attention earnestly to this question. Your property is situated, your works are situated, your industry is concentrated, and that of all the trades connected with your great industry, in the commercial ports of this country, which are inadequately defended. Now, the question resolves itself into four branches. I am only dealing with one, and that is the one that particularly affects you; but it involves these four questions:—The additional strengthening of the defences of our military and our commercial ports at home; the defence of our coaling stations abroad; the keeping open of the great ocean highways which provide the food and the material for the industry of our people; and lastly, but not

least, the defence of our Colonial ports. I am only dealing with the question of home ports at this moment; but these three other branches affect what I may call the extremities of our system. We all know that a man may lose his arm or his leg, and recover, and be in perfect health, and a useful member of society for the rest of his life; but a stab at the heart, gentlemen, paralyses every extremity, and by a stab at the heart I mean this: a successful attack upon any great commercial city or port in this country would have a moral effect, if it had nothing else, upon this country, that I for one tremble to contemplate. Therefore, I call your attention to this question. We have the opinion of the highest authorities that our defences are at present inadequate and that the necessity for strengthening them is urgent. I say no more upon it; it is for you to dwell upon the question, and I trust that the country will not lose sight of it.

Now, we hear a great deal, gentlemen, of our maritime supremacy. It is a phrase that is in everybody's mouth, and we are entitled—not to boast of it, but to maintain it, by reason of our insular position, and by reason, likewise, of the enormous share that we have in the trade of the world, by our own exertions. But, although that is such a common phrase in everybody's mouth, even the commonest of phrases in the language require every now and then to be looked at to know exactly what they mean. Now, I want to know how better we can maintain that maritime supremacy to which I say we are entitled, and to which I do not believe any economist has ever objected, and which I believe our foreign friends think that we are, by those two great reasons—our insular position and our immense trade—entitled to hold, than by pursuing the policy which in a few words I will show you we are pursuing—by "going ahead," gentlemen, and keeping ahead, at all cost, of every nation, in the construction and navigation of our ships. Now, the Admiralty are acting upon that policy. The Naval Estimates of this year nobody, however rigid an economist he may be, can, in reason, object to, I think, by reason of their extravagance. They are moderate estimates for what we have to provide. But they are singularly interesting estimates. I have looked at them with considerable care. I find that the building programme proposed, which is a moderate and reasonable programme, presents four new types of ship—almost entirely new types. Now just let me notice shortly what they are. There are two armed cruisers proposed, the *Blake* and the *Blenheim*: the one is to be built at Chatham; the other, I am happy to hear, is to be built by contract. These cruisers are to show a speed of 22 knots at sea. Their power may be estimated by their displacement, which is 9,000 tons, and their coal supply will be of such an amount that these two vessels will be able to run, at 10 knots speed, 15,000 knots at sea; and, at 20 knots, they will be able to run 3,000 knots. The next type, a particularly interesting one, as being an entirely new ship, is the Torpedo Depôt ship, the *Vulcan*, which is to be laid down. She is to be practically a very fast cruiser, of 18 knots. We have only one torpedo depôt ship at the present moment in the Navy, and she was taken from the Merchant Service originally; and I will appeal to any person connected with the Admiralty whether she has not proved perhaps as valuable a ship as we have in the fleet for the purpose of containing the reserve torpedo boats, and the means of repairing those boats, and all the intricate and complicated machinery that they contain. The *Vulcan*, as I have mentioned, will be a fast cruiser, capable of running 18 knots an hour, and she will be sufficiently armed to protect herself, at any rate, against the attack of any small craft. She will be a very awkward ship to tackle. The next class that I wish to call your attention to is an unprotected class; it is what is called the "*Sharpshooter*" class, which are torpedo gunboats, having a speed of 21 knots, and, as the title describes them, they are to be "torpedo gunboats," very formidable vessels; but what I am more particularly resting upon is the importance of their speed. The fourth class are improved powerful sloops—very different, indeed, from the old slow sloops. The two vessels are the *Basilisk* and the *Beagle*. They are of the same class as the *Buzzard*, of which we have heard a good deal. The power of those vessels will be shown by their 1,150 tons displacement. They are to run 14½ knots an hour, and they are to be provided with twin screws—a most important feature in them. Of course I need not say that they are intended for police purposes in distant seas and distant stations, it may be at the other end of the world. Those are four types of ship to which I especially would like to direct your attention, because they are comparatively new types of ship. This is to prove that the Admiralty, at any rate, is setting an excellent example in keeping ahead in the matter of novel construction of fighting ships.

But now the Merchant Service has, I think, even gone ahead of the Admiralty in this matter of superior construction, because, what do we see? I dare say there are one or two gentlemen here who, by the kind invitation of the Chairman of the P. & O. Company, Mr. Sutherland, went down the other day to the Albert Dock to see the *Oceana*. Now the *Oceana* is a vessel of which this country may well be proud, and Ireland may be well proud, seeing that she was built by the eminent firm of Messrs. Harland and Wolff, as was also her sister ship the *Arcadia*. She is one of the most beautiful vessels I have ever seen, and everybody who saw her agreed in that view. Happily, she has complied with the Admiralty conditions, and she appears on the list as an auxiliary to the Fleet in time of war, together with her sister ship. I may add that there are no less than four other vessels belonging to that great company which have quite recently been placed upon the Admiralty list. She is a very peculiar vessel, and well worthy of a visit. She has gone now upon her first voyage, and we will hope and trust that it will be a successful one, as I am sure the enterprise of her builders and the enterprise of her owners entitle them to expect. But, gentlemen, there are two vessels, one of which we heard of being launched only a few days ago, which I think every Naval Architect and Marine Engineer will watch with most extreme interest, I mean the *City of New York* and the *City of Paris*, built for the re-constituted Inman and International Line, and which are described to be superior to any vessels yet built. Their great peculiarity, as I understand it, is the minute subdivision of their hulls, and the interesting feature that their bulkheads have no doors whatever. No doubt the sad loss of the *Oregon* has been in the minds of designers; and an accident such as that which was the cause of the loss of that vesse cannot by any possibility occur in these vessels. They are to run, I believe, some 20 knots at sea, and undoubtedly they are entitled, from the description we have had of them, to be considered vessels of extraordinary merit. They are of an unusual length, and their displacement places them at the head of all the merchant ships that have ever yet been built in this country—it is no less than 10,500 tons displacement. Now, gentlemen, I allude to these particular vessels, Admiralty ships, and merchant steamers, to show that the policy which I say it is essential to pursue in order to maintain our naval supremacy, is being pursued both by the Admiralty of this country and by the merchant service, and it is to the honour of both, I think, to observe the efforts that are being made to maintain that supremacy.

I now come—and it is the last point that I shall trouble you with—to a very important Report that has been presented by a Royal Commission since we last met here: I mean the Commission to enquire into the loss of life at sea. When we met last here they had not presented their Report, and I made no allusion to it, but it has been presented since. There are one or two points in it that I particularly wish to direct your attention to; and the point I am now going to raise is not unconnected; on the contrary, it is closely connected with the material point that I have been alluding to, of our maritime supremacy. This is not the place, of course, to discuss many of the points that are raised in that Report of the Royal Commission, but there is one feature of the Report to which we can all look with equal pride and satisfaction, and that is, the general, almost unanimous, testimony (for I have looked through the Report with some care) that has been paid to the improvement, the general improvement, in our vessels; I am not speaking now of only the higher class of ships, but I mean of all our ships, including the cargo vessels of this country. For the sake of brevity and significance I cannot quote a higher authority than I am now going to quote in proof of the improvement—Mr. Dale. Now, who was Mr. Dale? He was the Chairman of the Liverpool Underwriters' Association, an Association which controls insurances to the extent of 200 millions a year. That is a sum that is very easy to state but is not very easy to realize in one's mind. Therefore Mr. Dale was a pretty good authority upon the subject that he was then speaking on. What did he say? He told the Commission that "premiums have been gradually falling for many years, and are now lower than I ever remember them." I think that speaks volumes for the improvement of our merchantmen. Mr. Glover, a man we all know, whose name is a household word in this great city, "put in tables showing that the reductions have been general in all trades, as well as large in amount." And our friend, Mr. Martell (I am always glad to see him here), said that "ships of the highest class are continually increasing in proportion to those of the lower grades." That is a pretty good testimony to the improving quality of our merchantmen. And our late lamented friend, Mr. Wm. Denny (I never mention his name without the deepest sorrow), spoke of "the great improvement in the cargo steamers of the North-East coast." I quote that testimony with great

pride, because I have had constant opportunities of observing the immense improvement, the almost incredible improvement, that there has been. I observed, only I think last week, a remark that was made by one of our leading shipowners which struck me as a most satisfactory and significant remark. Addressing a party collected on board a ship to witness its launch, he said, "Gentlemen, it is a great satisfaction to me to feel that every ship I put into the water is an improvement upon the last." Now I think I have shown you, upon authorities on which you may rely, that this improvement is remarkable in the whole of our merchant fleet almost from beginning to end. I should just like to quote one or two simple figures (it will not take me two minutes) to shew you by figures what proves the improvement; and that is the comparative increase in the size, the nominal horse-power, and the speed of our merchantmen attained in the last five years. These simple figures were furnished me by my friend, Mr. Martell, and therefore I vouch for the authority of them. Five years ago the average size was from 1,500 to 2,000 tons; that was in 1883; now it has risen to 3,000 to 3,500 tons in 1888. Nearly all the steamers that are now entered at Lloyd's for classification lift from 3,000 to 3,500 tons deadweight. The nominal horse-power has increased on an average from 140 to 200. The speed has increased from 9 to 10 knots. Now, gentlemen, I need not say that size, coupled with increased engine power, means power at sea, means greater safety, greater capabilities of battling with the waves and the storms, and shews, I think, without fear of contradiction, what a vast improvement there is going on in our mercantile navy.

Now, when we seek for the causes of improvement, of course, the first cause is the energy of our shipowners, and that is ably assisted by the vigilance of Lloyd's. But I think I am only claiming its due when I say that a considerable share of the encouragement to improved types in shipbuilding must be traced to the work and the efforts of this Institution and kindred institutions which I am happy to see have sprung up in other parts of the country, notably in Glasgow and on the Tyne. The subjects that are discussed here, the able papers that are read, the result of experiments upon every sort of subject connected with navigation, stability, the right form of screw propellers, fuel-saving appliances—all these matters are discussed and thrashed out here, and they must, necessarily, have had an effect, and an immense effect, upon the improvement to which I have spoken, and I hope not unduly spoken, with so much pride and satisfaction as signs of the times. Then there is another cause that I cannot help thinking has acted with considerable and valuable effect upon the improved types of our merchant vessels; and that is the Admiralty List of auxiliaries, because in order to get upon the Admiralty List, of course I need not tell you that certain conditions have to be complied with. Now this does not apply, of course, to the cargo steamers, because they do not aspire or they are not suited to be placed upon the Admiralty List. But the spirit of rivalry has a great deal to do with this. They have seen the improvements effected in these magnificent vessels (they are unequalled in the world) which are at this moment, I am happy to say, standing upon the Admiralty List, and they are stimulated, and they derive experience from the results of the performances of those vessels at sea; and they have followed the good example set them. Therefore, I trace to the Admiralty List a certain portion, at any rate, of the improvement that we observe in our merchant navy. Now, it is a cause, of immense satisfaction to think that the efforts of the Admiralty, the wise efforts of the Admiralty, have secured as auxiliaries (only auxiliaries) to our fleets in time of war the magnificent steamers belonging to the great lines of which I have spoken. And as long as they are only considered to be auxiliaries and not fighting ships—because a greater delusion we could not possibly fall into than to regard those ships as fighting ships—as long as they are regarded as auxiliaries to the fleet they will be an enormous source of strength, no doubt, should the emergency arise when their services will be called upon. I think the policy that the Admiralty have pursued now for a great many years is a most wise one in securing the services of those vessels. The Admiralty have improved in one respect, because they now, I understand, watch those vessels from the slips, from the time that they are laid down, to see that all the conditions in regard to compartments and strengthening of decks, the fitting of gun-racers and so forth are such as to suit those vessels for the purposes for which they may be used in time of war. I think that policy is an extremely wise one, and our gallant shipowners, who are always to the fore whenever there is a patriotic question raised and they think they can assist the country in any possible way, have met the Admiralty in an honorable manner, and we can boast of possessing upon that Admiralty List probably the finest steamers that the world has ever seen.

Gentlemen, I have detained you, I am afraid, at too great length, but these are subjects of very great importance that I have thought it only my duty to bring before you; and now, thanking you most heartily as I do for your kindness in listening to me, I will move the adoption of the report which has been read to you by the Secretary.

WORKING AND TEST PRESSURES FOR MARINE BOILERS.*

By RICHARD SENNETT, Esq., R.N., Member of Council.

FEW subjects in connection with marine engineering are of greater importance than those relating to the strength of boilers, and the maximum working pressures of steam that can be safely carried in marine boilers of ordinary form with plates of workable thickness. Many discussions respecting these points have taken place during the past few years in this and other scientific institutions, and they have generally been based on the question as to the minimum factor of safety that should be employed in the design of the boilers; the factor of safety being taken as the ratio in which the ultimate strength exceeds the working stress. This factor, which a few years ago was usually required to be from 6 to 8, has now been reduced in ordinary practice to from 4 to 5; which represents an increase of 40 to 50 per cent. in the working steam pressures allowed to be carried with a given thickness of plate.

There is, however, a danger that unless carefully guarded and defined, the factor of safety, even as now modified, may prove a bar to further progress, and it is important that we should fully realise what is meant by term "factor of safety" as applied to the strength of boilers.

Without entering into precise definition, it may perhaps be stated in general terms, that a factor of safety, as usually employed, is a somewhat rough and ready method of allowing for stresses, strains, and conditions which can neither be exactly calculated nor ascertained. In other words, it is to a great extent an allowance for want of knowledge. If the actual strength of a structure were exactly known, and all the forces acting on it could be correctly estimated, it would be a comparatively easy matter to make allowance for safety; safety being, as was pointed out by Professor Thomson in the discussion on Mr. Milton's paper at Glasgow, in 1877, simply a knowledge of sufficiency; and a factor of safety would then be simply an expression for sufficiency.

Until a comparatively recent date, marine boilers contained so many unknown quantities, that high factors of safety were justifiable. The material used was unreliable and far from uniform in strength and quality. The arrangement of the rivet seams, stays, &c., was often left practically in the hands of the foreman boiler-maker, rivet holes were punched and drifted, and all the work connected with boiler-making was of a somewhat rough and careless character.

With the introduction of high steam pressures and steel plates, much greater attention was paid to the quality of the materials and workmanship employed; the arrangement of the details was transferred generally from the boiler shop to the drawing office, and at the present time, fully as much care is exercised in the design and construction of the boiler, in all its parts, as in any other part of the machinery. The necessity for large factors of safety, therefore, no longer exists.

It, however, takes a long time to shake off old traditions, and we are still to some extent suffering from the influence of the earlier period, when a very different and inferior state of things existed, and it has only been by slow stages that we have come to realise that the ordinary rules of mechanics may be applied to boilers as safely and surely as to any other structure. Much credit for the advance already made in this respect is due to the enlightened view of the subject taken by Mr. Wm. Parker, the Chief Engineer-Surveyor of Lloyd's Register, and the increase of working steam pressures in the boilers of the Mercantile Marine has been much facilitated by the excellent rules framed under his directions.

In Mr. F. C. Marshall's paper on the "Progress and Development of the Marine Engine," read at the summer meeting of this Institution at Newcastle last year, favourable reference is made

* *Read at the Twenty-ninth Session of the Institution of Naval Architects, March 21st, 1888; the Right Hon. the Earl of Ravensworth, President, in the Chair.*

to a recent modification in the Admiralty specifications for boilers, by which the working steam pressure allowed for shell plates of a given thickness is considerably greater than would be approved by the rules either of the Board of Trade or of Lloyd's Register, which latter are practically identical with those that formerly governed the Admiralty practice.

In the discussion that followed the reading of that paper, Mr. W. H. White and Mr. A. C. Kirk expressed their concurrence with the new regulation, but Mr. Parker, whose opinion on this subject must necessarily carry great weight, took some exception to it. I was unable to be present at that meeting, and am therefore glad to avail myself of the present opportunity of discussing the question, and feel sanguine that a brief explanation will suffice to remove from the mind of my friend, Mr. Parker, any misapprehension as to the soundness of the principle on which the present Admiralty rule is based.

The furnaces and combustion chambers, especially the latter, are the most critical parts of marine boilers of the present type. It is clearly impossible to calculate or ascertain exactly how the material in these parts is affected by the bending, flanging, welding, &c., during manufacture, or the stresses and strains produced by the temperature of the fire and the pressure of the water when the boiler is at work. They are also the thinnest parts of the boilers, and consequently liable to be the most seriously affected by wear or corrosion. It has, however, been ascertained from extended and successful practice, which is the only safe guide for these parts of boilers, what are the minimum scantlings that should be allowed for a given working pressure; and for furnaces and combustion chambers, the rules of the Board of Trade, Lloyd's Register, and the Admiralty are practically identical. In Fox's corrugated flue, now so generally used, we have a very strong form of furnace, which will enable the present type of marine boiler to be retained for considerably higher steam pressures than are now ordinarily used, provided the rules applied to the shells are suitably modified to keep the thickness of the shell plates within workable limits. This is the direction in which all progress has hitherto been made.

When Mr. Milton read his paper at Glasgow in 1877 the ordinary working pressures in marine boilers were from 60 to 70 lbs. per square inch, and he pointed out that under the then existing rules further progress was barred in consequence of the required thickness of shell plates. These rules, after much debate and considerable opposition, were modified, with the result that working steam pressures of 140 to 150 lbs. per square inch, and in some cases still higher, are now general in marine boilers, and great gain in economy of fuel has been thereby effected.

The present Admiralty rule for the maximum working steam pressure to be allowed with a given thickness of shell plates simply takes us one step further in the same direction, and I will briefly point out where it differs from, and, in my opinion, is in advance of, the ordinary rules on this point.

The Board of Trade rules give a minimum factor of safety of 5 for boilers made of the best materials and by the best workmanship, provided they have been open to inspection during the whole period of construction. Numerous additions to this factor are made in cases in which the above conditions are not complied with. The rules of Lloyd's Register, which, as before stated, are practically identical with Admiralty practice hitherto, provide for a factor of safety of 4 to 5, varying with the thickness of plate, the lower factor being taken for the thicker plates, as corrosion on them would have less relative effect. As regards this, however, it must be remembered that when the joints are fitted with inside butt straps, the body of the shells may be reduced by corrosion 20 to 25 per cent., without affecting the strength of the boiler.

In each case the water-test pressure is required to be double the specified working pressure. This means that with a factor of safety of 4 the stress produced by the water-test pressure would be equal to one-half the ultimate strength of the shell, which would in most cases be near the elastic limit of the material. For any factor below 4 it is practically certain that, with this system of testing, the water pressure test would injure the boiler. While, therefore, a water-test pressure of double the working steam pressure is retained, any reduction of the factor of safety below 4, as applied to the working pressure, would be impossible.

Although it has been the traditional practice to apply to marine boilers a test pressure of double the working pressure, there is no real justification or necessity for it, especially with the pressures now in use; and the retention of this practice is a hindrance to further progress. It is on this point alone that the recent Admiralty rule differs in principle from the practice ordinarily adopted for marine boilers.

To the shells of cylindrical boilers almost exact calculation can be applied. The material now used is reliable and practically uniform in quality, every plate is tested, and the rivet seams carefully designed and constructed; so that there is no difficulty whatever in determining both the strength of the structure and the stresses it has to bear. In the consideration of this question the principal point to be kept in view is, not the ultimate or breaking strength, but the "proof strength;" that is, the stress required to produce the greatest strain consistent with safety. This may be taken approximately at about one-half the ultimate strength. Boilers, like all other structures, should be designed to safely withstand the greatest stress that is likely to be brought on them, which is, or should be, the test pressure; and it is essential that this test should be within the "proof strength," so that no injury may be caused by its repeated application. All that would then be necessary for safety would be to make the working pressure somewhat less than the test pressure; so as to ensure that if failure occurred at all it should be during proof, and not when the boiler was at work.

The present Admiralty rules provide that the stress produced by the water-pressure test shall not exceed 4-9ths of the ultimate strength of the shell, so that it shall be well within the elastic limit of the material, and the test may be applied as often as may be desired without injury to the structure. The boiler is therefore designed so that, when subjected to the water-test pressure, the shells have a factor of safety of $2\frac{1}{4}$. So far this is in accord with the ordinary rules for a boiler designed for a factor of safety at the working pressure of $4\frac{1}{2}$.

The working steam pressure is not, however, now reduced to one-half the water test pressure, for which there is no good reason, but is fixed at 90 lbs. per square inch below the test pressure, which provides ample margin for safety. It will be seen that this rule does not affect the strength of the boilers, nor the hydraulic test applied to plates of a certain scantling; but only modifies the practice regulating the greatest working steam pressure to be allowed in a boiler of given strength, by making it a certain fixed amount below the test pressure, instead of its being one-half the test pressure in all cases.

I may say, in passing, that the margin of 90 lbs. is purely arbitrary, and was adopted simply for convenience, because that was the maximum working steam pressure in general use in the Navy prior to the adoption of the new rule, and the selection of this figure simplified the revised general orders respecting the testing of naval boilers, which, in accordance with the Admiralty Regulations, have to be tested by water pressure twice a year.

The advantage of using this constant margin between the working and test pressures instead of a percentage margin is greater than may, perhaps, at first sight appear. The most serious drawback to the ordinary rules, which make the maximum working steam pressure one-half the water test pressure, is that they severely handicap the higher pressures. When the ordinary working steam pressure in marine boilers was 20 lbs. per square in., the water test pressure was 40 lbs., which gave a margin of 20 lbs. between the working and test pressures, and experience proved this to be ample. When the steam pressure rose to 60 lbs., the rules required a margin of 60 lbs. between the working and test pressures; at 90 lbs. working pressure the margin was 90 lbs., and so on; the margin between the working and test pressures increasing directly as the working pressure was increased. It is, I think, sufficient to simply state this to show how unnecessary the traditional test of double the working pressure is, and how seriously it operates against further increase of working pressure.

By the revised Admiralty rule this difficulty is obviated, and if the principle on which it is based were generally adopted, the weight and cost of boilers for a given working pressure would be reduced, and considerably higher steam pressures than are now possible could, if desired, be carried in marine boilers of existing form and dimensions without reducing their safety in the slightest degree.

The effect of this rule may, perhaps, be most clearly seen by its application to an actual example. The boilers of H.M. ships *Medea* and *Medusa*, and the other high-speed cruisers of that class, are about 12 ft. in diameter, and are designed to carry a working steam pressure of 155 lbs. per square in. The water test pressure in accordance with our new rule is 90 lbs. in excess of this, or 245 lbs. per square in., and at this pressure the shells will have a factor of safety of $2\frac{1}{4}$, as previously explained. This requires a thickness of shell plates of $\frac{1}{2}\frac{3}{4}$ in. By Lloyd's rules the shell plates for the same working pressure would require to be $1\frac{5}{16}$ in. thick; by the Board of Trade rules it would require to be $1\frac{1}{4}$ in.

The working steam pressure of these boilers, as actually con-

structed, would, by Lloyd's rules, be limited to 123 lbs. per square in.; and by the Board of Trade rules not more than 110 lbs. per square in. could be carried: the water test pressure, which is the real gauge of safety, being practically the same in each case.

The thickness of shell plates required by Lloyd's rules for this working pressure of 155 lbs. would, by the revised Admiralty rule, be sufficient for a working pressure of 220 lbs.; and the minimum thickness required by the rules of the Board of Trade for a steam pressure of 155 lbs. per square in. would suffice, by the Admiralty rule, for a working pressure of 250 lbs., or more than 60 per cent. greater. The weight of these boilers, for each ship, as actually made, is 14 tons less than would be required by Lloyd's, and 19 tons less than the minimum allowed by the Board of Trade rules for the same working steam pressure. The total weight of the shell plates in the *Medea's* boilers is 52 tons.

Although in order to illustrate the effect of this rule in facilitating the further increase of the working pressures, I have been obliged to compare it with those of the Board of Trade and of Lloyd's Register, which govern the design of boilers in the Mercantile Marine, I hope it will be clearly understood that nothing is further from my desire than the revival of any controversy on these points. My sole object has been to bring into prominence the retarding influence of this traditional hydraulic test pressure for boilers, of double the working steam pressure, which we have all hitherto accepted as an axiom, but which the Admiralty have now given up as being unnecessary, and which, in general practice, is not applied to other structures.

In conclusion, I would say that there is nothing novel in the present Admiralty regulation, except, perhaps, in its application to marine boilers, which have always been over-weighted by excessive and unnecessary caution. The successful experience, extending over a long period of years, with locomotive and land boilers, conclusively proves that considerably greater working steam pressures, for a given strength of boiler, than are now customary in general marine practice can be carried with perfect safety. Sir Frederick Bramwell, in a letter published with the discussion on Mr. Milton's paper, in 1883, stated that if the rules for marine boilers were enforced for locomotives, the ordinary working pressure of 140 lbs. would be reduced to so low a point that the whole railway service, both passenger and goods, would be paralyzed. The regulations affecting the working and test pressures that have almost universally been applied to locomotive boilers are in principle the same as those now adopted by the Admiralty for the boilers of H.M. ships, and there is no reason whatever to doubt that they can, with perfect safety and much advantage, be applied to all marine boilers, and, if generally adopted, further economy of coal in steamships might reasonably be expected from the higher working steam pressures that would be thereby rendered practicable.

DISCUSSION ON MR. SENNETT'S PAPER.

Mr. A. C. Kirk:—My lord and gentlemen,—We have had from Mr. Sennett perhaps the most important paper that we have had for some time on any subject, for the construction of steam boilers is at the root of all marine engineering, aye, and of all other engineering too. The great importance of this paper of Mr. Sennett's is not that he raises a new subject, nor is it that he treats it perhaps in a new way; but he brings it before us as an accomplished fact. Now in this world of ours you may demonstrate propositions in an abstract way sometimes for a very long period, aye, perhaps for as long as you like, but the single example of an accomplished fact from a competent authority goes often much further than either mathematics or logic. Looked at in that way, I value this paper of Mr. Sennett's exceedingly. Now this is not a subject that we have had before us for the first time by any means. Though I have not had an opportunity here to refer to the transactions, and I speak somewhat from memory, we have had, I think, at least two important discussions bearing very much on the same subject; and I think every marine engineer in the country has thought about it and has endeavoured to move some little way at least more or less in Mr. Sennett's direction, but, as you all know, we are not our own masters. Technical education schools have been established throughout the country, and we are told that we shall all have to be educated as high class engineers, and that on the Continent and elsewhere engineers are better educated than we are and compete with us on that account. That I totally deny. But you will remember this, that in these matters education goes for nothing whatever, and that we simply move like a railway locomotive on a set of lines that are laid down for us, and that from these we are not allowed to deviate and, in fact, if we exercise our own judgment we get nothing but a rebuff. Now I think everyone looking in a common sense way at this paper of Mr. Sennett's will see that Mr. Sennett, in modifying the scantlings of the boilers in Her Majesty's Navy (where, fortunately, there are no such lines of rails over which everyone is compelled to move) has acted according to the dictates of common sense and experience. He has rejected a factor of safety, and instead of treating it by multiplication he has treated it very much by addition. Hitherto, at least up to very lately, in the Admiralty, and at present in all the merchant service, we still have to work according to factors of safety. The introduction of the higher pressure steam in the *Aberdeen* was a means of practically effecting some improvement in these matters, and I said, if I recollect rightly, in a paper here regarding that ship that the construction of these boilers had been facilitated by their being built under the rules of Lloyd's Registry, and not under those of the Board of Trade. A very influential gentleman in the Board of Trade asked me what I meant by that. I said I simply meant that they had been facilitated, and that they had been built under rules which, whether we considered them perfect or not, at any rate were much more rational than theirs. Almost about that time, or very soon after, I had a correspondence with the Board of Trade on the subject, which was printed as a confidential paper, and, therefore, I am not at liberty exactly to lay it before you, nor would time suffice, nor your patience stand, if I were to read the whole of it. My proposition at that time, a purely tentative one, and not brought into the more perfect shape in which Mr. Sennett has put it, although coming to, roughly speaking, about the same result, was that up to 70 lbs. pressure we might retain a factor of safety of 5; up to 100 lbs. a factor of safety of 4½; and up to 150 lbs. a factor of safety of 4. Such was my proposition to the Board of Trade in 1882, and my reasons for proposing a reduction of the factor of safety for higher pressures were that the factor of safety was intended to cover, first, inferior material; second, mal-construction; thirdly, inferior workmanship, and fourthly, corrosion. Now, inferior material is a thing of the past, I think I may say. Under the advance in steel making, and under the very stringent testings that the Board of Trade submit all the steel materials of a boiler to (they do not do it to iron, recollect) inferiority of material is, as I say, a thing of the past. In fact, at present in the larger plates of boiler shells four test pieces are taken, one from each corner of the plate. That enhances the cost of the steel about £1 a ton. However, that is not a point we would grudge provided we got any benefit from it, which at present we do not. Mal-construction in a cylindrical shell is also a thing which is, as I should say, impossible, and certainly impossible under the superintendence of any reasonably educated Board whatever. The strength of the rivet joints is perfectly well known by many experiments made, and is provided for by the rules of the Board of Trade, to which I am just now not taking any special exception, and by the rules of Lloyd's Register which are, in fact, deductions from experiments that have been made, some published and some not. As to the security of manhole doors, &c., that is provided for, always by strong doubling plates or something equivalent. So far as the boiler shell is concerned, I say malconstruction is to be put out of account altogether. Now, as to inferior workmanship, no doubt there is a small field open for inferior workmanship; but when you recollect that in the mercantile marine the boilers, whether under the Board of Trade alone or under the Lloyd's Register alone, have the workmanship inspected during progress, and if every step is not exactly seen, the methods of working are perfectly well known to the surveyors, the field for a factor of safety to operate upon in that direction is at least very small. Now we come to the next point, corrosion. I have no doubt Mr. Sennett, under whose care the boilers have to last a reasonable time, has looked carefully to that, and the proportions that he gives cover that; and for this reason, that corrosion now is actually in well-made boilers a very small affair indeed. Even in the old and dark days of boiler making, before either Lloyd's or the Board of Trade took anything whatever to do with them, I know boilers were made that have run quite eighteen years. But perhaps you will say there are cases of corrosion still—there are boilers that are wasted. Well, no doubt; but when they are they are wasted through the incompetency of the engineers who work them, or through the stinginess of those who employ the engineers who manage them, it matters not which; and certainly to handicap the whole profession and the whole body of shipowners by having not only to pay for a uselessly heavy boiler but to have that boiler carried abou

as an unremunerative part of the ship all the days of the ship's life, because some men misconduct themselves, is a monstrosity. Of course our friends at Lloyd's have to take somewhat more account of corrosion, because they act for the underwriter and the shipowner, and they all naturally expect the boilers to last for some reasonable time. I do not know exactly what the time might be put at, but still they expect them to last for several years; and naturally you would expect Lloyd's to put on a somewhat larger margin for a factor of safety than the Board of Trade have any business to do, whose certificate lasts only for a twelvemonth. If the Board of Trade see that the boiler at the end of a twelvemonth is safe for a passenger carrier, they have fulfilled their function, and I consider that they go quite out of their way in concerning themselves in any way at all about the eternal durability of a steam boiler; that is a matter for the shipowners. Let the Board of Trade see that the boiler is safe, that is their function, and let the shipowner say to himself, How much shall I add to that to serve my purposes? I may say that in this correspondence here the sort of argument drawn against reducing the factor of safety or the thickness of plates was largely based upon the uncertainty of material. In their replies to my letters allusions are made to the fact that some steel plates have cracked, and a great deal is made of the plates of the *Livadia*, which you will all recollect somehow or other (for it was discussed at our meetings here, and I need not refer to it) got into a state in which you could break them off with a hand hammer across the edge of an anvil; but as I said here and repeat now, for such a thing as that there is no factor of safety possible; no factor of safety will make that boiler safe, and therefore that has no bearing on the argument at all; and just as little have those questions of the cracks in steel plates, which in my experience have entirely vanished, but which for anything I know might occasionally show themselves in some other experience. With regard to such accidents as that, no factors of safety whatever will do any good. The crack is in the plate from the beginning, I have no doubt, in every case; and whether or not, the thickening of the plate will not prevent that crack from happening at all; therefore these sort of arguments might as well be thrown to the wind. Other gentlemen, no doubt, have their views to express on the matter, and I will not say more, except that I would again compliment Mr. Sennett and the Admiralty, with whose approval it has been done, on taking a step which, although sanctioned by all common sense and experience, was still a very strong step to take in face of the long prejudice that had existed in favour of the former state of things in the marine service.

Mr. F. C. Marshall—My lord and gentlemen, I am sure that every marine engineer present will endorse the remarks of our friend Mr. Kirk with regard to the value and the importance of the paper which Mr. Sennett has just read, and we are very much indebted, I think, to the Admiralty for their permission that Mr. Sennett should lay before us such a paper as this, and we are indebted to Mr. Sennett for the very broad and liberal view and common sense view which he has taken of this whole question. We have all felt for many years, one might almost say the absurdity of the double-pressure water test, and more especially since we came to know so fully the value of the materials with which we had to deal. I quite endorse Mr. Kirk's remarks in reference to the wisdom and justice of Lloyd's and the Board of Trade taking the position they did with regard to iron boilers when we scarcely knew at all the quality of the material with which we had to work, and when the workmanship was generally or very frequently of a very inferior quality, and when the rule, as in the case of other commandments, was made for the sinners and not for those who did their work properly and did their duty faithfully. But I think we are all satisfied now, thanks to our friend Mr. Parker, and thanks to the Board of Trade and to the Admiralty that the time of defective workmanship in boilers and of faulty materials of which boilers have been constructed is gone. We can now, as has been rightly said by Mr. Kirk, rely absolutely upon the material with which we have to deal, and now that we have boilers of steel that is tested in the way in which it is, so carefully, so rigidly, now that we have workmanship so carefully guarded as it is, and the care on the part of designers, which is now so manifest in all boiler construction, the time has certainly gone by when we should have such an arbitrary factor as doubling the working pressure to be the guide of the thickness and strength of the material with which we have to deal. The rule of Mr. Sennett, I believe, practically takes into account the Board of Trade rule in an indirect manner; that is, if I understand it rightly, and as we are in the habit of using it, he arrives at the thickness required by taking the working pressure *plus* 90, and using the Board of Trade rule multiplied by two. That is, he really halves the working pressure practically in that way.

Mr. Sennett—No.

Mr. Marshall—You apply the Board of Trade rule to your increased pressure.

Mr. Sennett—The working pressure, *plus* 90, is supposed to be four-ninths of the ultimate strength.

Mr. Marshall—That Mr. Sennett is justified in that is, I think, perfectly manifest even from the Board of Trade rule itself, and I submit this for Mr. Parker's serious consideration. The Board of Trade rule, if you will remember, takes steel at the value of 26 tons, and it takes iron at the value of 20 tons. Now, when this rule was made, I submit that these were fair maximum pressures for the materials with which we had to do; that is, we had not confidence in steel, and, therefore, so low an amount as 26 tons was taken as a guide for that rule. But now they give us a margin, and very properly, of from 26 to 30 tons; and we know perfectly well that these boilers are safe, therefore I submit that the factor of 250 for the steel boiler might be increased up to at least 280. And then they have taken, or they took at the time, as they were anxious to get maximum results, 20 tons as the load for iron. Well, we all know that 18 tons would have been a very much more correct amount than 20 tons. Then we know boilers were made with 18 tons material, which certainly could not be reckoned to work more than 16 hours; but, if you take the co-efficients of 18 and 28, multiplied by 10, as the constants to be used in the Board of Trade rule, you arrive very nearly at the amount that Mr. Sennett has fixed upon for 150 lbs., that is, for the *Medea* and the *Medusa's* boilers. We should arrive very much at the same calculation so far as 150 lbs. is concerned, but if we wish to go higher than that then we have to increase the co-efficients. I most cordially endorse the principle laid down by Mr. Sennett of fixing the addition to be made to the working pressure. I think it is a safe, a simple, and an easy way of arriving at the strength of boiler shells. With regard to the other parts of the boilers, as Mr. Sennett has said, I should say that we are quite right in the present system. All the thought and care and attention that have been devoted both by the Admiralty and by the Board of Trade and by Lloyd's to the question of corrosion in the various parts of the interior of the boilers are fully justified, I think, by the results of long experience; therefore, Mr. Sennett's practice there is quite endorsed, and the principle upon which he has worked it out is perfectly sound. I would also mention, what Mr. Kirk has also alluded to, the great importance of this question as reducing the weight of the materials which we have to carry on board ship. It is really quite unnecessary that we should load our boilers with anything like the enormous weight of material that we have been doing in time past, and this gives us a great opportunity of reducing the weight of boilers and the weight of machinery. But the advantages that may accrue, and will accrue, for the increased working pressures that are made available by this practice, by the rule now introduced by Mr. Sennett, are, I think, important. They will enable us to give much higher pressures, and to secure the economy which we know is available by using higher pressures.

Mr. E. A. Cowper—I have just a few words to say in reference to this matter. As I am constantly making boilers, I feel that a great responsibility rests on every one of us in exercising our judgment as to what degree of safety we shall give to the boilers. It is not a matter that we can relegate to anybody else; it is a thing that we must each of us judge for ourselves, and we have to take the responsibility; and I think the great thanks of the meeting are due to Mr. Sennett for bringing this subject forward to be properly ventilated. The material we are using now of course is so infinitely better, or so very largely better, than anything we had in past times, that we can now, as Mr. Sennett says, calculate much more closely upon what is possible and what is not possible. I consider that one argument in the paper will scarcely hold water. It is that question in reference to Sir Frederick Bramwell's letter. He stated "that if the rules for marine boilers were enforced for locomotives, the ordinary working pressure of 140 lbs. would be reduced to so low a point that the whole railway service, both passenger and goods, would be paralysed." I think that that is a little putting the cart before the horse, because the result would be this: that the boilers would be made a little stronger—not that the railway traffic would be paralysed, but that the boilers would be strong enough to carry what they were required to carry. That is not the question. I dissent from many persons in the way of calculating the capacity of boilers. I have been fortunate in having no accidents of any sort or kind, and I therefore still hold to my opinion. I do not think the ultimate strength of the steel or the iron is the point to be calculated upon; but I think the elastic limit is the point to be calculated upon; and, if you go beyond the elastic limit in working or proving, the boiler is not the same as it was at first; it is a different boiler; the rivets may have gone oval, the plates stretched a bit, some of the

metal just at the point of giving way altogether; but if you stretch a boiler it generally will leak very much before much harm takes place. I am very pleased to remember that once when I happened to be President of the Institute of Mechanical Engineers, I requested Mr. Smith, of Barrow, to make me a small boiler about 2 ft. diameter, 4 ft. long, and ¼ in. plates; and I said that we would burst it if we could. When the Institution were down at Barrow, Mr. Smith kindly put the pumps on; we had all the men to them, and we went at it hard. It strained and leaked at 320 lbs. to 1 in.! I found out afterwards that the temptation had been too strong for the fireman, and that he had had 420 lbs. on before we proved it, and then he caulked it up again; but the boiler leaked like a riddle all over. I mention this because it happened that I had requested this boiler to be made before the *Livadia*'s plates gave way. Everybody was full of it at the meeting; and this example of good mild steel was so extremely satisfactory. I am happy to say it went some way in reassuring people, and re-establishing the confidence which was somewhat shaken by the case of the *Livadia*'s plates. That is the reason I mention this, because I rejoice in having fortunately hit upon the method. I think, gentlemen, we must all consider and take upon ourselves the responsibility of saying how safe we are going to be. My own opinion is strongly that we ought to know that the boiler will not give out at twice what we are going to work it at. Therefore I prove it at twice to make quite sure that we have got that strength, but in proving it twice I keep just within the elastic limit, and then you are safe. I do not think that with any boiler there is any right on the part of the engineers or stokers to say that they cannot help running up to double the pressure, but if it is merely a certain amount to be added to the working pressure, it all depends upon how much that is, as to whether it may or may not be run up to; and I think there is a greater chance of running up to 90 lbs. when you are working at 150 or 160 than there is of running up to 90 lbs. when you are working at 40 or 50; therefore I put a larger margin, and should certainly say that it ought to be increased as the pressure increases, and I still hold the opinion that proving at twice is the right thing. With reference to the point I was noticing about Sir Frederick Bramwell's letter about the boilers, I think the circumstances cannot compare; because in a locomotive it is half of the time, or nearly half of the time, in the shops; it is under operation every hour of its life all over, in every direction—underneath, roundabout, and everywhere else, and often opened and inspected inside. Therefore, as a rule, it is well looked after, and as a rule it lasts pretty well a lifetime—at all events, two lifetimes, there are plenty of locomotive boilers that are two years old. Now, a marine boiler is not open to inspection in many cases, nor even on the sides in certain [illegible] is steam; and it has to be kept going often for [illegible] without stopping, without being examined, and is exposed at all times to salt water, and rust the shell in an unknown degree. I [illegible] boilers to boil neutral grease into acid [illegible] the patent of Tileman, taken out in 1855, [illegible] in 1856. We found that by boiling at [illegible] and by pumping through a coil we could [illegible] We then tried how much lower we [illegible] to the inch in four hours and a half we [illegible] into acid grease, almost as acid as [illegible] boiler made of a good size, 2 ft. diameter, [illegible] to twice 220, I confess to that, but [illegible] half as much again. I put it in a [illegible] it could not blow up the men; it was [illegible] that is the reason I dared to go to [illegible] worked very well, and we had half-a-[illegible] which answered the purpose. I mention [illegible] with the boiling of grease into [illegible] with the late Sir Joshua Field, [illegible] surface condensers, and also with Sir [illegible] advising them to use surface con-[illegible] Sir Joshua Field said that the [illegible], he did not know how or when, [illegible] surface condensing, it set up very [illegible] holes in the boilers. That is [illegible] was; it is the grease that is [illegible] acid grease; and in this very [illegible] to this Institution, for it had [illegible] a meeting of the Mechanical [illegible] of cutting the boilers, by the

[illegible] and gentlemen, I feel some [illegible] after such eminent practical men as Mr. Sennett, and Mr. Kirk, and Mr. Marshall have spoken, but I feel very strongly on the opposite side of the case to the way they have taken it up, and I do not think the whole common sense of the case is at all on the side they have taken up, and I wish to point out as temperately as Mr. Sennett has (if he will allow me to say so) pointed out the case from his point of view, but as strongly as I can, why I think the common sense of the case is not entirely on that side. I have read this paper two or three times with very great care, and the argument appears to me to be this: "We require to use as high pressures as possible; it is very inconvenient for us to use thick shells, let us make them thinner." There really is not anything more. It is said that there are some people who do not like to pay their debts, and who grumble very much when they are not allowed to write them off if it is inconvenient for them to pay. It appears to me that from a practical point of view this is just the same thing: "It is not convenient to have an inch plate, let us put on ⅞ in. plate and let the thing go." It does not amount to very much more. Mr. Sennett says, and I think this is a point upon which I must join issue with him very distinctly:—"The direction in which all progress has hitherto been made has been"—what?—"the modification of rules for the shells." Now, my lord, engineering progress is not made in the direction of modification of rules, and we are not going to make progress if all we can do is to persuade Mr. Parker and other people to modify their rules. The only way in which we can make progress is by using better material and not making these wretched holes in our plates, or by using another design of boilers, or something of that kind; that I think would be a genuine piece of engineering progress; and then let us get our rules modified afterwards, but if we are to progress by modifying our rules first I think that is a topsy-turvy procedure. I think Mr. Sennett's proposals divide really into two parts, which are separable. There is the one about not testing a boiler to twice its intended working pressure, and the other about increasing the working pressure in proportion to the tenacity of the plate. Let us take the second first; that is to say, should the test pressure be always twice the working pressure. Of course that is a matter of opinion to a very great extent, but here again I must to some extent join issue with Mr. Sennett as a matter of practical fact. Mr. Sennett says, "All that would then be necessary for safety would be to make the working pressure somewhat less than the test pressure." Now is a hydraulic pressure with cold water the same thing as steam pressure? It appears to me to be entirely different. I think nobody could say that the stress in the plates of a boiler would be the same thing when they are pressed with 100 lbs. per square inch of water pressure, as it would be when they were strained, heated, cooled, and twisted and bent with 100 lbs. of steam pressure, with all its accompanying changes of temperature. I really do not know that I should like to say that in the *Medea* the boiler was very much more strained with 245 lbs. per square inch hydraulic test than it was with 155 lbs. water pressure. I do not think any of us know very well, but it appears to me that we must not compare the two as if the pressures were directly comparable quantities. Then the second and by far the most important point is this, I think, put into plain English—if I may venture to say so, it has been put into not quite plain English—but if we put it into plain English the whole question is this, shall the working stress in a riveted joint bear a ratio to the strength of the plate out of which it is made, that is, a greater ratio than the working stress bears to the strength of any other part of the engine, boiler, or apparatus altogether? I really think it comes very much to that, and one wants to know then what is the justification for using this very high stress. I will endeavour to justify what I have said by figures directly. I do not see any justification for using a higher ratio of working stress to limit of elasticity or working stress to tenacity of plate in a boiler than the similar ratio in a piston rod, or in a connecting rod, or in a crank shaft, except this one point, that the boiler is tested; but I must say that I think that is a shadowy point rather, especially when my friend Mr. Sennett proposes to pull down the test. The boiler has been tested, the crank shaft has not been tested, and then propose to pull down the ratio of the test to the work. Now Mr. Sennett says you cannot apply exact calculation to a boiler.

Mr. SENNETT—To a shell of a boiler.

Professor KENNEDY—I beg pardon. To the shell of a boiler. I wish one could apply exact calculation to the shell of a boiler. We have tested with very great care the tenacity of the plates of which a boiler is made. We judiciously make the plates of our boilers so that the break may be at the rivets generally, I think, and we know absolutely nothing about the strength of those rivets

in sheers. It is perfectly shocking the kind of material that is provided for rivets, and supposed to be of proper quality in using steel rivets. I assure you I have had, within the last few months, at any rate, a rivet bar which had a sheering resistance of anything from 18 tons up to 26 tons, and I have had rivets which would not break at 24 tons, and other rivets supposed to be exactly the same stuff which break at 16 tons. Now, with such a margin as that for one part of our joint, which is at least as important as the plate, I do not think we do know the stress. Really, I think that is putting it too strongly. Then we do not know the strength of the plate as it is affected by perforation. That is generally, however, an increase of strength. We certainly do not know the effect of local straining and heat, and as Mr. Sennett has pointed out the flanged corners, and so on.

Mr. SENNETT—Not in the shells.

Professor KENNEDY—But in the shell joints; surely the end of the boiler is flanged.

Mr. SENNETT—That has nothing to do with the shell.

Professor KENNEDY—I know, of course, that it is not the shell-plates that are flanged, but the flange joints come where the shell-plate comes, and any local inequalities caused by strains in the end plate will certainly cause—at least, I think so—inequalities of stress in the shell-plates to which they are connected. However, that is a matter of opinion; of course, it is not a matter of actual fact. I do not think there are many bits of an engine to which we cannot apply, if we are reasonable and rational, just about as exact calculations as we can in this case; and I do not think there is any reason why we should single out the boiler, the one case of all others where failure would be most dangerous, for taking a very large working stress. Now, very fortunately, Mr. Sennett has given us an example, the *Medea*, and I have worked out what that actually comes out at. That boiler works at 155 lbs. pressure, and its collapsing pressure is calculated to be 550, or somewhere thereabouts. Now that comes to this, that the stress in the solid part of the plate is about 5½ tons per square inch, and between the rivet holes at the joints is about 8 tons per square inch. I have assumed the plate to be 28 tons, which, I suppose, I may take it to be about. That means that the joint is assumed to be somewhere about 70 per cent. of the strength of the solid plate. I doubt very much whether any joint that has been made in any of these boilers in ½ of an inch plates has a strength of 70 per cent. of the plate. I know how very difficult it is to do, for I have had a great deal to do with the riveting of joints and the testing of them. I have not the details of a joint before me; I can only say that I feel it difficult to believe that such a joint would really have 70 per cent. of the strength of the plate; but if I am told that it has, of course I entirely accept the statement. I do not know where else an Engineer works 20 ton steel with a stress of 8 tons per square inch. There may be other places, but they are certainly few and far between, to the best of my belief. If you are using that kind of steel in a bridge, even for the dead load, I question whether many engineers would run their stress up to 8 tons per square inch, if they were using 28 ton steel, I mean. It may be so, but that is a very exceptional case indeed, and I question whether many engineers would do it. I really think that in boilers least of all is it advisable to push up the stress without at least some more cogent reasons than we have at present had given. In the illustrations which Mr. Sennett drew from locomotive works, I think surely he is mistaken. Locomotive practice is a matter of common knowledge. The stress in the plates of one of Mr. Webb's compound locomotives, working at 175 lbs. pressure, or in Mr. Worsdell's locomotive, working at 170 lbs. pressure, is assuming the joint to be 70 per cent., 5¼ tons to the square inch, not eight tons, and that is a joint of a ½-in. plate, which is a very much handier thing, and a thing we know a great deal more about than we do about an inch plate. 5¼ tons is sufficient for 175 lbs. per square inch in the most modern locomotives we have. Now there is a great difference between using 8 tons to the square inch in ½ plates; and I do not think, therefore, that we must admit that the locomotive practice justifies this alteration, although the alteration may, of course, be justified on other grounds. I would venture strongly to urge that improvement in boiler making lies not in the direction of deliberately increasing the ratio between the working stress and the tenacity of the plate; but rather in the direction of using a better design of boiler, or a better design of joint than at present we seem to be pushed up to. Of course I quite admit the difficulties of this, but I think that that is the engineering way of looking at it. I hope, my lord, I have not put the matter too strongly, but there is such a weight of authority on the other side that I feit that if I was to make any impression at all I would have to say as distinctly as I could what I thought would be the truth.

Mr. C. E. STROMEYER—My lord and gentlemen—This subject is, of course, interesting to me as to all other engineers, especially as I have had a great deal to do with boilers during the last few years. I will not deal with the question of boilers in the Navy; I suppose Mr. Sennett is the best judge, or certainly by far a better judge of the question than I am, but when he comes to the merchant navy and proposes this rule for merchant boilers, I think that my opinion is also of some weight in the matter. Looking at the question in this way, both the Board of Trade and the Admiralty are two Government departments. In framing these new rules Mr. Sennett undoubtedly consulted with the Board of Trade.

Mr. SENNETT—No.

Mr. STROMEYER—Well, Mr. Sennett says he has not done that. I was going to say that in that case the difference that exists between the rules of the Board of Trade and those of the Admiralty, shows that the Admiralty treat their boilers in a very much better way than the Board of Trade find that the merchant steamers are treated, and therefore, although the rules may be justifiable in the Navy, I do not think they are quite justified in the merchant service. Mr. Sennett, in his remarks about this 90 lbs. pressure which he has fixed upon, says that double the working pressure is a perfectly arbitrary standard. Well, I consider that the 90 lbs. is equally arbitrary. I do not see why we should not have taken a departure in the days when the boiler pressure was 60 lbs., and then have fixed it at 60 lbs., or when it was 40 lbs. and then have fixed it at 40 lbs. I think that the 90 lbs. is quite as arbitrary as the double working pressure. I would like to draw attention to this. Ten years ago, if an extra pressure of 40 lbs. above the working pressure had been fixed upon we could never have detected the bad plates in the *Livadia* boilers, nor in those boilers which subsequently failed. They failed at very nearly the test pressure; and if we had only tested them to about 40 lbs. above the working pressure, they would have gone into the ship, steam would have been got up, and we should have had an explosion. As Mr. Sennett has said, double the working pressure is an arbitrary standard, and perhaps it is not a right thing; but in framing a new standard I do not think it was right to take another arbitrary standard. The way to arrive at a new standard would be from experience. In old boilers I do not think that any surveyor would recommend going above one-and-a-half times the working pressure; and the reason is this, all the joints of the boilers are not made to stand that pressure; all the joints are old, and you would certainly injure your boiler if you tested them to double the working pressure; one-and-a-half times the working pressure is therefore fixed by the weakest part of the structure, but the weak part does not endanger the safety, of the boiler. Now, in testing a boiler when it is newly constructed you ought to go as high as possible with your test pressure, as high as the structure of the boiler will allow. Mr. Sennett has pointed out that the material and workmanship are better now then formerly, and therefore, I do not know that he says this, but I think we ought to go higher in our test pressure, and I think we have done so; we have gone 20 per cent. higher since the drilling of holes and other improvements were introduced. But why, when the test pressure has been increased 25 per cent. should we only add 20 per cent. to the working pressure? I think the working pressure ought to go in the same proportion as the test pressure. Then there are internal parts of the boiler; Mr. Sennett is reducing the test pressure of those parts by about 50 per cent. He says that we are guided as regards internal pressure by the previous practice, but he is allowing a greater working pressure of the internal parts. The working pressure is fixed according to the rules now in existence for the internal parts, but you do not test those internal parts to double the working pressure, you only test them to one-and-a-half the working pressure; you cannot test them to double. The boiler has got a shell which you do not venture to test to 90 lbs. above the working pressure; therefore the internal parts, which are only 1½ in. thick and are liable to give you far more trouble than the shell, are only tested to 90 lbs. above the working pressure. Professor Kennedy has drawn attention to the great difference in temperature that exists between the time when the test is applied and when steam is up. I am very glad that he has drawn attention to it; I also had intended to draw attention to it, and there are a few figures which I think will be interesting to you. At one atmosphere, that is, at 212 lbs. pressure, the temperature of the steam is about 150 degrees above the temperature of the water with which they have been tested so that the difference of conditions would be represented by this 150°. At 150 lbs. the difference of temperature is 300°, which is twice as much. Mr. Sennett hints at higher pressures, so I have gone to very much higher pressures; I have gone to 450 lbs. There you get a difference of 400°. Now, if you compare these

temperatures with certain points of the behaviour of steel you will find that the higher you get in your pressure the higher you get in your temperature, and the nearer you approach the point of the material in which it is known to be in its most dangerous condition. The black heat is about 600°; and when you have come to about 150° you have reduced the difference which separated you from the limit by one half. Now, I do not think we know anything at all about the behaviour of steel at these high temperatures. It would certainly be interesting to know how it does behave, but I do not know that experiments have been made on it, and to base any new rules or ideas of that sort I do not think is quite justifiable. I think that the greater the difference (as Professor Kennedy has pointed out) in the conditions the greater we ought to have the test pressure, and instead of reducing the ratio of the test pressure to the working pressure I think we ought to increase it for the higher temperature, and not reduce it. Those are all objections to the principle of the new rules, and I should like to point out a few objections in the matter of details. When the new rule is framed I think the rule ought to be far more comprehensive than the rules which had preceded it. We have got far more experience now in the working of boilers. Mr. Sennett puts forward a proposition which we have all heard about—the fixing of the working pressure—and I should have thought that a new rule would have included low-pressure boilers and high-pressure boilers as well; but this is evidently only a rule for that one particular pressure. We will begin at the low pressure: suppose we went to 45 lbs., that is the pressure at which a donkey boiler ought always to be constructed. I do not think there is any use in going very much higher than that: so that this is really the practical question. Suppose we construct a boiler at 45 lbs., or at least, construct it according to our present rules at 45 lbs.; the test pressure would be 90 lbs. Now, according to Mr. Sennett's rules that boiler is incapable of standing any test pressure at all, because he subtracts 90 lbs. from the pressure, and yet he got nothing. Now, going in another direction, suppose you go up to these high pressures, 300 or 400 lbs. per square inch, you allow a factor of safety of about 3. Well, I should not like to be in a stokehold where I knew that the boiler was being steamed to about one-third of its utmost strength and capacity. I do not think it would be safe. I think I have shown plainly enough what my point is, but I have a formula here which I might perhaps add subsequently. It shows the rate at which the factor of safety reduces at various temperatures. We find that the factor of safety at, say, 450 lbs. per square inch is reduced to 3, and when you come down to 45 lbs. you have got an infinite factor of safety as I have already shown. Mr. Sennett does not allow any pressure at all. Of course I quite understand that this rule is only meant for strains of about 150 or 160 lbs.; but in framing new rules I think they should allow for everything. Why not frame a rule which would cover or try to cover everything? I do not very much like the rule as it is. Of course Mr. Sennett is the best judge of what the Navy requires, but I should think, that the shell-plate of a marine boiler ought really to be a fixed part of a boiler. In the Navy they allow you to dispense with part of your protection, but if you have got a plate which 1¼ in. thick I think it is very much better protection than to reduce it if possible to 1 inch, and then put a thin deck over it. I think it would be almost better to increase the thickness of the shell to an inch and a half, and do away with the 1-in. deck over it to protect it. I do not mean to say so dogmatically, but it seems to me that the shell of the boiler is the thing that holds all the steam together, and when you are going into action you ought to be sure that the thing will not burst.

Mr. E. A. Cowper—May I say one word in explanation? I always prove my boilers hot, and a boiler that is tight cold will leak when it is hot. That I have proved.

Mr. Daniel Adamson—Perhaps I ought to apologise for being here at all, as I have no connection whatever, directly, with marine engineering; but on the other hand I have had some experience in the use of steel and the manufacture of steel boilers, having a few thousands at work since I introduced steel in 1857 and 1858, and probably I have the advantage and the experience to speak with authority that I have had no accident arising from the use of steel. It has been a great blessing to mankind that we have got a material that is so nearly equally strong in both directions. As Mr. Marshall pointed out to you, we had Old Ireland concrete before that time that would break in its transverse direction at certainly not exceeding 16 tons per square inch, although it might be sold to carry 22 tons longitudinally, and flat bars that I have often tested in iron will be reduced in their lateral carrying power from 22 tons to 8 tons by the interposed cinder. Now, if there was no other factor to be taken into account than that which have listened to, I should presume that the increased working pressure was desirable, and founded on reasonable and rational considerations; but I cannot help but think that the author of the paper has looked at it purely from a manufacturer's point of view as an engineer, but he has not looked at it at all in the light of its fundamental law and operation—that is, are we likely to get plates either now or in the near future that are uniform in carrying power over the extent of four or five tons. I hold that the misfortune that we now labour under is that we have to make for large plates large ingots, and if we make large ingots we have a large bulk of metal that is a long while coming, and if the extent of the five common alloys that are now understood to be always associated either with the mildest or the strongest steels is to be the governing power of strength, of utility, or malleability (and I hold they are certainly so), then we must know what material we get, and how it has been treated before it came into our hands. Now, the misfortune is that we cannot depend yet entirely on the mild steel material. It is true we get an approximately good material, but when you cast ingots, and the common alloys differ in specific gravity, the steel being at 7·85, and the manganese, the second element that is employed, at 8·0, and then fall down all of a sudden to sulphur, with only a specific gravity of 2·0, and phosphorus at 1·77. When you cast an ingot in a chilled ingot box, that instantly cools the outer circumference, and fixes the alloys with a moderate certainty, but leaves them to disassociate and to wander about at will during the cooling process, during two or three hours, in the centre of the box. Now with carbon—take it as dense as a diamond—at a specific gravity of 3·5, we find that it will, with an ingot 6 ft. in depth, allowed to cool by its atmospheric action, vary from a mild steel compound at ·22 to a highly treacherous steel compound on the top of ·72 to ·78. I say it is utterly impossible, then, that you can depend so entirely on the material that you get, unless you can fix these alloys and get them to be moderately uniform, any more than you could depend upon the time when you would draw the last breath of your life. It is an uncertainty that can never be obviated with the material that you get. It is true that the French, in making the material for guns, do throw away one-third of the entire ingot; but it is such a loss that the British manufacturer would not like to follow the highly technically trained Frenchman and throw away one-third of his entire property. I would rather he went about it in a more practical way, and insured the fusion of the alloys as far as poossible, and so secure as little loss as possible, with great homogeneity and dependability, and I fancy we would be likely to get that from the steel experts of great practical wisdom, that is now used in carrying on the steel trade of this country. I used, in my earlier time, Bessemer steel to the extent of making 1,400 steel boilers, entirely Bessemer metal. Subsequently I supplemented that to the extent of 3,000 steel boilers, that are working at this day, varying in pressure from 50 lbs. to 250 lbs. to the square inch. I have never found any difficulty in the simple strain. I quite concur with the author of the paper that as far as the shell of a short boiler is concerned it can be understood and comprehended, and a properly accurate formula got out, but it does not apply to long structures; it does not apply to complex structures, and it does not apply in strict formula as regards the strength of the metal to all those internal parts that are subject to everlasting disorganisation by variable temperature and variable pressure. Let me explain the latter point by the explosion of a locomotive of the L. & N.W. Railway thirty years ago, when the accuracy of workmanship was not of a high standard, and when accuracy of thought was not very high either. At that time the locomotive boiler shell was riveted with one longitudinal riveted joint, and although small boilers with a ⅜ plate only disorganised the true circle to the extent of ⅜, yet the rapid rise and fall of the pressure, which we all know is so common in locomotives, resulted in a longitudinal break and ultimate disaster. Now, if such a small fragmentary disturbance as the thickness of a ⅜ plate would produce first a break and ultimately destruction, then I think we can understand that variable temperature and rapid changes of pressure are the things that we have to watch and to contend with in our everyday practice, even in marine boilers, and especially of that type if they be longer and double-ended. In the course of my experience I have occasionally looked upon the heating of a boiler that goes into a blast furnace; in fact I may say one of my own boilers, and have watched with awful consternation one end of it rise up 3½ ins. by applying the gas quickly to the bottom of the boiler alone. Why, sir, there is no formula of calculation of the strength of the material, no ratio of a standard factor of security that is going to meet the case of such disturbance and disorganisation as is developed under such unfortunate practical experience, and I hold that England is

pre-eminently in advance of other countries because she is so thoroughly practical, and watches the practical points to protect her in her great engineering and commercial operations. Now there is no doubt at present the necessity for pressure is further forced upon us. We have the treble and the quadruple engine coming rapidly into use; and perhaps I have a right to address you as being the author of the system. Like most inventors, I have got a considerable loss for my pains, and have further seen the necessity at early times for a higher class structure. I took it upon myself to drill instead of punching the hole. My first efforts to drill boiler shells into position date back to 1861 or 1862, and during the life of those patents, I certainly never had a sixpence of royalty, but I had an awful lot of opposition from those who went in for punching, which produced disorganisation in the whole system of manufacture, then, sir, to a mechanical appliance and to a more accurate and universal knowledge of connection and security. The barbarous system of punching is gone for ever, and we have now got accurate mechanical true holes instead, upon which you can depend if you know what the composition of the material is. Now I would not have you be frightened to the extent that the impression would be conveyed by Prof. Kennedy's statement that you get a material of so disproportionate a character as from 20 tons or 24 tons to 28 tons or 30 tons. Why, if the Professor had given us the composition of the metal referred to, we would have known in a moment that it was sadly wanting in uniformity, and there was the true explanation why it carried so little, or occasionally much more, and in all our investigations and tests I hold that we must strictly adhere, not only to the quantity of alloy that we use in the metal, but the relative quantities of the common alloys that we all know are incorporated, as we cannot get rid of them, and those that we administer in the shape of carbon and manganese. Latterly I think you have had, through the kindred Institution, a wonderful statement about a new alloy of manganese, above 14 per cent., giving a stronger metal and a more endurable action with greater ductility than has ever been submitted to the engineering profession before. Therefore, if that be true that an alloy for once is going to give us strength as they all give hardness, but, at the same time, if it is going to confer additional ductility, it will be a new departure, and of the greatest importance to the whole of the manufacturing industry, connected with engineering, of this country and of the world. I would rather discuss this matter more with regard to the fundamental law—the law that governs the application of metals—than from the point of view of any Parliamentary disposition or law prescribed by any association. I think that if mechanical structures have to depend on the advancement of such formula, we shall make no advancement at all. We can only make advance by having before our minds the fundamental principles upon which structural security depends, and not the light formula or any quantitative formula, however substantially it may be supported, and however accurately conclusions may be derived from it. I will not trouble you any further, because my experience, as I have said, has not been in marine structures; but I know this much, that in using steel at a rather higher temperature than its normal condition as we find it, it somewhat increases in strength; and any of our young friends need not be frightened until he gets a pressure introduced of about 350 degrees. Then we come to the margin of cooler temperature, where risk and anxiety will fill every engineer's heart with dread. Therefore, the limit is not, according to my experience, the temperature that you get. It is the superinduced temperature that you have to watch, and that becomes more troublesome in a compound structure with the strain that you put upon it.

Mr. W. H. White—Mr. Adamson has not given us the benefit of his opinion upon the critical point in Mr. Sennett's paper, viz., whether he does or does not agree with recent Admiralty practice in having a constant difference between the working pressure and test pressure. If he would kindly add that, I am sure it would be of great advantage in the discussion.

Mr. Adamson—In my own works, the factor of safety for shells is 5. As to the factor of safety in the disorganised and disturbed parts subject to a regular pressure, we consider the load should never exceed four tons per section, approximately a seventh of the material that we use. Then as regards the test pressure either of double the working pressure or of 90 lbs., I think that they both are very unwise. It should be a *pro rata* pressure, a test pressure dependent on the pressure that your structure has to work at. It is not necessary, I think, that you should have double the working pressure for a boiler of 200 tons per square inch. In my case, where I have a large number of large boilers working now at 150 lbs. per square inch, I should not like to have tested them at 300. I think they were tested at 220, and I am satisfied that that may be depended upon. But even this I do not put forward as a strong argument, but the united body of engineers and metallurgists ought to fix a test pressure *pro rata* to the working pressure that the structure has to bear.

Mr. Reynolds (Sheffield)—My lord, I should not have risen now, as there are so many great authorities present, but I think it desirable to notice some loose statements that have been made by Mr. Adamson as to what happened in casting steel ingots. I am not going to enter into the subject at any length. Unfortunately for steel makers, phosphorus has not that happy knack of floating up because it is light; it has so extraordinary an affinity for iron that we are not able to get rid of it in that way. Then there is another thing. I am sure that everyone in this meeting will strongly sympathise with Mr. Sennett and his colleagues at the Admiralty in the extraordinary difficulty in which they are placed to carry their points at all, and in doing so they have a perfect right to go to the extreme limit of what they may consider safe; but I apprehend that the object of the paper is to elicit the opinion of authorities like those who have spoken—Mr. Kirk, Mr. Marshall, and our other friends—on the general subject. But, as stated by some other speakers, it is very much a question for the engineer himself, so far as the mercantile marine is concerned, and we steel makers who may be responsible very often for the insufficiency of the material. So far as we are concerned, the main point of the paper is the suggestion that instead of double the working pressure for the test pressure, which may, with such strength as he proposes, approach and actually reach after a very small corrosion the elastic limit, we should have a fixed margin for corrosion, arbitrary if you like, and depend upon it. That is a thing that I hope to hear treated by more competent authorities; but the real danger of this paper arises from the strong inclination there is amongst marine constructors for the mercantile navy to follow such a lead. We all know the difficulties that they stand in, but unfortunately I cannot help feeling that it is with many of them very much a question of price. Now I happen to have a pretty extensive acquaintance amongst managing owners of ships, and their managing engineers, and I have never heard yet from one of them an expression of opinion that we should like to have a weaker boiler; and I think there is very strong probability that he would have to pay pretty much the same price for it if he did get one. Then, perhaps, I should not have a right to go so far as that if I had not something of a remedy to propose. I believe I was the first originator of the suggestion that boilers, instead of being made of 1¼ in. plates, for example, might easily be made of laminations of thinner plates, and I know that some practical engineers have dissented from that view, and I shall have to make a boiler myself to show the facility of it, because it is perfectly easy. Taking the boilers from the *Medea* and the *Medusa*, there would be no difficulty whatever in making a boiler of 37 ft. in circumference with plates ⅝ in. thick. Mr. Adamson raised a point in connection with the length of the plate which I think it is well to correct without waiting for Mr. Sennett to do so in his reply. He referred to the fact of the French makers cutting away a third of the ingot. Now I am certain that of the work sold by the Company into which I have drifted for many years, certainly in no case is as much as two-thirds of the ingot sold, so that it would be no new practice to cut away a third as is done for the French Artillery, and far larger proportions are cut away in English works so far as my knowledge goes. In rolling those ring plates, plates I mean to make a complete circle of the boiler, another advantage might I think be introduced. I have seen a great many boilers cut up in which the upper part of the inside of the shell had suffered exceedingly little. Now when you get plates extending for the whole circumference of the boiler it is perfectly easy to have the seams entirely above the water level, and so to cover them by internal covering plates that the seam *per se* is not an element of wear. And then it might be practicable possibly, and it might be found wise, to go a little nearer to the ultimate strength of the other part of the boiler, because the margin down by the seam might be perhaps worked upon. But so far as my own opinion is of value I should be very sorry to go below the liberal limits now allowed by Lloyd's, and I am certain that I speak for many shipowners,

Mr. Alexander Taylor—My lord and gentlemen, it appears to me a great pity that we have not many more shipowners here to say something about this boiler question. I am quite satisfied that few shipowners would care to have the factor of safety reduced. I remember that at the time when we had 25 lbs. working pressure the usual age for a boiler was about five years. I do not think they consider that age satisfactory. I know it was a

complaint all round, and they endeavoured in every shape and form to lengthen the life of that boiler. When we increased the pressure to about 80 lbs. we probably had the same factor of safety, but the extra thickness allowed for a greater margin of corrosion, and the life of a boiler would be then run up to about, on an average, nine years, which was considered a very great improvement upon the old low pressure boiler, and for that reason alone they looked with great favour upon the 80 lbs. pressure boiler. Now, since greater pressures have been introduced Lloyd's and the Board of Trade as well—anyhow, Lloyd's—allow certain factors for thin plates and others for thicker plates to allow for this corrosion that they have experience about. I certainly think that if you were to canvass the country at the present time and asked the shipowners what life they wished a boiler to have, you would not get any of them to say that it ought to be five years or even eight years; they would expect much more, and I think that you would find that they would at least expect fifteen years' life out of a boiler. Why should they have the ship laid up, the decks pulled up, and the whole ship thrown into confusion and a large expense incurred to renew the boiler at five or even ten years of age, if by carrying a little weight, and a very small proportion of increased weight, they could make this safe to last a matter of fifteen years, or practically the life of the ship in many cases? It appears to me that the gentlemen who have gone in particularly for this reduction of factor are shipbuilders or engineers, and, of course, they can much better make, and I believe it would suit them in many ways to make, lighter boilers. At the same time, as soon as it is once ground down to one thing, ultimately the shipowner must get the benefit of the reduction in price. It is a matter of competition merely. Then, if I understand the paper right, the writer does not propose to touch the factors of the furnace combustion chambers or stays, but simply the shell. Then the mercantile marine is compared with the Admiralty practice. I would ask is it the practice in the Admiralty to work these boilers for fifty per cent. of the year all their life at these pressures that have been given to us—that is, at the working pressure they are made for? I know very little about the Admiralty practice, but as far as I can gather, these boilers do not work fifty per cent. of their time at their working pressure, while in the mercantile marine I have found from actual experience they work about fifty per cent. of their life under their maximum pressure; and that is a very great difference, and to my fancy falsifies the Admiralty comparison completely.

Mr. W. Parker—My lord and gentlemen, I must state, in the first place, that I am very much obliged to Mr. Sennett for having written this paper and cleared up certain questions that arose in my mind when my friend Mr. Marshall made the extraordinary statement at the meeting at Newcastle last year. Looking over the paper casually it does not appear to be dangerous; it appears to be a harmless paper, but when it is looked at carefully, and the propositions that it contains, if applied generally it would lead to a most dangerous practice. Let us take, first of all, these points and see what the propositions put forth by Mr. Sennett are. Mr. Sennett takes the strength of the material at the riveted seam—the ultimate strength of the material—and four-ninths of that strength he calls the test pressure. He then takes 90 lbs. from that, and that he terms the working pressure. That reduces the strength of his *structure* to about one-half what would be allowed by the Board of Trade or by Lloyd's. What is this factor of safety intended to cover? As far as I can gather from Mr. Sennett's paper, and taking the four-ninths of the ultimate strength of the material it is intended to cover this, to be quite sure you are within the limit of the elasticity of the material. Now I would like to ask the engineers who are here what is the limit of elasticity of steel that is being worked in different ways. I attended a meeting of the Institution of Civil Engineers some little while ago, when a paper read by Colonel Maitland on the treatment of gun steel was being discussed, and there I heard no less an authority than Sir Frederick Bramwell make this statement. He says "that it was commonly said that if the elastic limit were passed the material was being destroyed; it was done for; the one great crime for which there was no forgiveness had been committed; the material would all go to pieces; but as far as he was concerned he did not know what the elastic limit of a piece of steel was." Now, that is the opinion of Sir Frederick Bramwell. I have made a series of experiments during the past year on some 50 or 60 pieces of steel for the purpose of ascertaining how the physical properties of that material altered under the various work that was put upon it. The steel had in its normal state a tenacity of 20 tons to the square inch, and when worked and bent into the form in which it would require to be bent for the boiler shell it still had a tenacity of 28 tons to the square inch. The limit of elasticity while in its normal state was 14·8 tons, about half; but the limit of elasticity after it had been worked fell to something below 11 tons. Now, if Mr. Sennett considers that the only element to cover in the designing of boiler shells and fixing the factor of safety is the limit of elasticity, then I think he is treading on rather dangerous ground.

Are there not other elements to affect the strength of a structure like a boiler shell? I think there are a great number. My friend, Mr. Kirk, and others do not think so. They think, as I have stated over and over again, that we know pretty well the strength of the material, we know pretty well the strength of the joint, and therefore the greatest thing to be covered is corrosion. But we do not know the absolute strength of the material, nor do we know the absolute strength of the joint. How do you arrive at the strength of the joint, to commence with? We calculate its strength, but it is purely a theoretical strength, and out of all the joints that have been tested I have never found one of them come up to that theoretical strength. Every joint that has been tested has been below the theoretical strength, even as far as 10 per cent. Should we not have a margin of safety to cover that? Then there is another element. In the case of a vessel steaming full speed at sea and suddenly stopping, the pressure in the boiler accumulates, and will accumulate up to 10 per cent. Should not we have a factor of safety to cover that, in cases of vessels stopping at sea? Now as to the element of corrosion. In Mr. Sennett's paper he does not allow anything for corrosion. He considers that there being a lap inside and a lap outside there is no factor of safety required for corrosion. Now I point you to these plates here. Here is a plate that was originally three-quarter inch thick, but it is corroded in the life of eleven years down to two-thirds its strength. Should not we have some factor of safety to cover that?

Mr. Adamson—Is that corroded part covered by a butt strap?

Mr. Parker—No; the butt strap is on the other side; it is the rivet head that is here.

Mr. Kirk—Is that an iron boiler?

Mr. Parker—That is an iron boiler. Then I go to another element. There is the unknown strength of the riveted joint, the accumulation of pressure, and the loss from corrosion. Now, there are strains in the corrosion of the boiler other than those that we can calculate. As Mr. Adamson truly remarked, when a boiler is being fired, and severely fired, it is under altogether different conditions to those that exist when it is being only moderately fired; and again, it is a different structure and has different strains exerted upon it. Just take one of these boilers and imagine for a moment that in one part there is a temperature of 1,800 or 2,000 degrees and in another part only 200 degrees. You will admit that there are strains there that must be naturally set up that no man can calculate. No man knows what they are or are not; and I think we should have a further factor of safety to cover that. Apart from those strains, the strains that are produced by unequal temperature, even in the manufacturing of one of these large boilers, in rolling these plates, as has been shown over and over again, plates that weigh five tons, 25 ft. in length and 5 ft. wide and 1¼ in. thick—up to those dimensions, when these plates have been put into the furnace and brought out one part cold and another hot, strains have been discovered in them to such an extent that when the hydraulic test was applied to them they gave way long before they got to double the working pressure. Now, with these cases before us, with this experience, would it be wise, would it be prudent, would it be safe to reduce the factors of safety that we know are giving so much satisfaction? Then again, apart from the strains that I have referred to, there are, as everyone knows, in working with marine engines and marine boilers more particularly, strains that we know nothing of, latent defects, defects that we know nothing at all about, existing in the plates. Now, as an illustration of those latent defects that exist I will just refer you to the disastrous explosion that took place at Southampton a little while ago. Certainly, that was not the boiler that gave way, but it was a steam pipe that had a supposed factor of safety of ten times, and it had an actual factor of safety, so far as the hydraulic test could be applied, of two and a half times the working pressure, but when the steam was admitted to that pipe it gave way at the working pressure and killed everybody that was near. Now, if one of these boiler shells from any unknown cause of that sort should happen to give way and burst, I do not know what the consequences would be. Looking to the experience that we have of land boiler explosions, where it tears away everything in the vicinity, I have very few doubts but that that ship would go to the bottom and everybody with it, and it would be a disgrace to the engineering world that such a thing should happen when we are now able to calculate

these things so nicely. Then again, I would like to ask why should we make this reduction? What is the object? To save weight, I should presume. Now, I will take a boiler 12 ft. in diameter and 10 ft. long. I find, by going through this calculation of Mr. Sennett's, that he would allow 220 lbs. pressure for that. Well, we of the Board of Trade (and it is the general practice of the kingdom) would only allow 150 lbs. Why do you take the risk? Simply to reduce the boiler 1½ tons in the weight (is it worth it?) or to increase the pressure from 150 lbs. to 220 lbs. What do you obtain by that? As my friend, Mr. Kirk, has often said in these meetings, the economy does not decrease in the same ratio that the pressure decreases, and therefore why take all this risk?

Mr. KIRK—But you could have quadruple engines to some effect.

Mr. PARKER—It is very questionable. You cannot take anything more out of the steel than there is in it, whether you put it through quadruple engines or treble expansion engines, you cannot get anything more, and Mr. Kirk has stated over and over again that if you go from 100 lbs. to 150 lbs. you get a saving, but that if you go from 150 lbs. to 200 lbs. you do not get anything like the same saving. Now I would just like to say one word with regard to the last paragraph of Mr. Sennett's paper about this proposition entirely agreeing with the locomotive practice. I am sure Mr. Sennett must have been badly informed, because since I have had the pleasure of reading this paper, I have made inquiries to strengthen the views that I held before reading this paper, and to make myself quite sure that I had not made any mistake. I have letters from the principal locomotive superintendents of this kingdom. I asked them in my letter:—"Kindly say what factor of safety you require in constructing your locomotive boilers, and what you consider that factor of safety should cover. Now Mr. Sennett's factor of safety, bear in mind, is 3·1, the locomotive engineers unanimously say that they would not think of working any of their boilers at a lower factor than between 5 and 6. Since sitting in this room my friend Mr. Marshall has presented a telegram to me from some locomotive people, who say the very same thing. Now I will just read to you one letter that I have received from one of these eminent locomotive people. I will give you the name because I am quite sure you will not object to it. It is no less a personage than Mr. Deaves, of the Great Western Railway, dating from his Works at Swindon. I asked Mr. Deaves this question, and he writes me this. I beg your special attention to this because this covers the whole ground in dispute:—"Dear Mr. Parker, In reply to yours of yesterday, the theoretical strength of our locomotive boilers is made equal at least to six times the working pressure, with perhaps a slightly less margin in the butt joints, with straps inside and outside, which are placed above the water line. This factor has been adopted, not only with a view to allow a margin for defects which may exist in plates or stays without external indications, but also in order to prevent the deterioration which would ultimately be caused by the constantly recurring strains if they have too high a proportion to the strength of the material, and further to cover possible local reductions of strength by corrosion in parts readily accessible for examination. From all our experience with locomotive boilers carrying 140 and sometimes higher pressures, there does not seem to be any reason to consider this factor of 6·21 too high." Now, there is a letter from one of the principal locomotive engineers in the kingdom that states directly the contrary to what Mr. Sennett tells us in his paper. He must, in my opinion, have been very much misinformed, or he would never have put this before us. However, I hope I have not been too strong in what I have said; as I said before, I am glad that Mr. Sennett has brought this paper before us because it clears this up, and I am sure that if the marine engineering world imagine that they are labouring under arbitrary rules or anything of that sort, if they will unanimously—not one or two of them, but unanimously—submit the matter in a proper way to Lloyd's Register Committee, they will give it their consideration, and not only their consideration, but they will themselves, at least I will myself, go and confer with every one of them so that we can exchange views. But do not let us make a radical sweep like this. If we exchange views together we can perhaps arrive at a common understanding. I mention this, particularly, now, because my friend Mr. Kirk is here, and I wish it to be distinctly understood after this meeting is concluded that we do not upon any consideration, at Lloyd's, wish the world to think that we are arrogant or overbearing. On the other hand, we wish them to understand that it is our sole wish that we should help the shipbuilders and the marine engineers, and above everything else that we should not be considered obstructionists.

At this point an adjournment took place for luncheon.

ADMIRAL DE HORSEY—My lord and gentlemen, I should like to ask the meeting whether they consider, assuming that Mr. Sennett's estimate of 90 lbs. to be added to his working pressure is the right one for the test, with that particular working pressure it is well to establish that as a rule—whether applying a constant instead of a factor is to treat the matter in a scientific manner. If you apply his constant of 90 lbs. to a working pressure of 45 lbs. you will be testing your boiler at three times the working pressure; if you apply the constant of 90 lbs. to a pressure of 180 lbs. you will be testing your boiler at one and a half times the working pressure. Would it be right? I cannot conceive that such a rule would be admitted; but supposing it is admitted, would it be right to have a rule so different in its results? It seems to me that a factor is a proper thing, whether it should be a decreasing factor, as I believe it should, as the pressure increases or not, but a constant appears to me to be wrong. We all sympathise very much with the Admiralty in their endeavours to reduce weight; in these days, when everything is being done to promote speed they try to skip the weight everywhere. I am afraid that is the truth, but I do trust that this will not be done in the case of the boilers. If we compare the boilers of men-of-war with the boilers of our best merchant ships I am afraid our Navy boilers would stand very poorly in the comparison. I speak from many years' experience of my own service in the navy, and I speak from several voyages in our best lines of mail packets in which it has been my pleasure to spend my time with the chief engineers; and I have seen with pleasure the simple manner in which they maintain their pressure and speed for day after day, and week after week, a thing perfectly unknown to us in the Navy. They maintain what is to them their full power pressure, and that is the normal state of things, and the boiler takes no harm. If we attempt that in the Navy, what is the result? At the end of a few days, if not a few hours, everything begins to go wrong. We have not as yet succeeded in keeping up high speeds; our tubes get choked, our boilers begin to leak, and certainly I think that the steam companies have nothing to learn from us. I think we have a great deal to learn from the steam companies. I cannot but think that any economy in the substance of your boiler is a very dangerous thing. I am afraid that if it is carried out we may hear of some man-of-war going to sea, and not being heard of for so many weeks or months. We have heard a graphic account before luncheon of what might be the result of the bursting of a boiler at present high pressure. I should like any scientific man to conceive the effect of that in a gale of wind at sea, where, in addition to all the strains which have been so well mentioned, there is one which has perhaps not been alluded to, and that is the constant surging of the water in the boiler, the ship pitching and swaying and making strains in all directions; that must be some sort of difficulty. I should be very much afraid that if we adopt the minimum of pressure, the very least we can do with, as I have said, we shall some day hear of a ship that went to sea and did not come back. I do not wish Mr. Sennett any harm. I am very much indebted to him for his clever paper, of which he knows fifty times as much as I can pretend to do, but I should like him to go to sea in those ships with the reduced thickness of boilers.

Mr. PARKER—My lord, I would just like to say a word or two. I am afraid that the words that I uttered in the latter parts of the remarks that I had to make have given some personal offence to our friend Mr. Kirk. I sincerely hope that is not so, because in making use of those words I merely tried to show to this meeting how we of Lloyd's Register dealt with the various structures and forms that come before us, and how anxious we were with the engineering world at large to do what was right. I did not for a moment mean to give offence to Mr. Kirk, and I hope Mr. Kirk will not think so, for nothing could cause me greater regret.

Mr. J. SCOTT—My lord and gentlemen, I should like to say, on commencing the few remarks which I shall endeavour to make on this very interesting paper, that I feel frequently when I come in this room to attend the discussions of the Institution, that I go away, after having heard doctrines preached by some rather eminent members of the Institution, which have the effect upon me, as a practical man and as a maker of metals, somewhat as if I should never like to touch a plate of metal again. We have heard some doctrines with regard to the unreliability of steel, both in its original construction and after it had been worked, that I thought had a long time been exploded. Professor Kennedy referred to some extraordinary examples of, I suppose, steel. I do not know that he said steel, but I take it to be steel, that had been passing through his hands, which presented a most extra-

ordinary degree of unreliability which I could not have fancied existed in any steel now manufactured. I think this discussion limits itself entirely into the question of the shell—the interior parts of the boiler—by Mr. Sennett's proposition and by the Admiralty practice remaining very much as they have been in the past, and as is found described in Lloyd's and the Board of Trade rules. The only difference, as far as the consideration of the internal part is concerned, being that the proof-pressure is less than that applied by the Registration Society. Now, as far as the shell question is concerned, if I rightly gathered what Mr. Parker stated, he found a difference in strength in the elastic limit of shell plates of from 14, which he took as the normal one, to 11 per cent. of the working. Now, he did not state whether that working was cold or hot, or in what part of the shell it had developed itself. I should like to know whether it was in the flanges of the shell or in the circular part of it.

Mr. PARKER—May I be allowed to explain that I think I stated that I found that the limit of elasticity of a piece of steel varied considerably as the amount of work you put upon it? I conducted a series of experiments upon some 50 or 100, and they were just straight strips of steel. The steel, in its normal condition, stood at 58 tons and had a limit of elasticity of 14 tons.

Mr. SCOTT—I asked whether it was hot or cold.

Mr. PARKER—A straight plate, cold. When the plate had been bent to the curvature that it would require to be bent in the boiler, and bent back again the limit of elasticity fell from 14 tons down to something like 10 tons.

Mr. SCOTT—I must leave it to be cleared up afterwards, but that is not the question I asked. The question I asked was, whether the fall in the elasticity had taken place under parts of the boiler which were worked cold, or parts which were worked hot?

Mr. PARKER—Worked cold.

Mr. SCOTT—Well, I can hardly believe that that statement represents what is the normal condition of cold working boiler plates, but, of course, I do not hesitate to accept Mr. Parker's statement. I must say, however, that if it was true it would go a very long way to modify my ideas about what was safety in the matter, and I must say that it has astonished me. I asked that question specially, because Mr. Parker referred to the use of the shell. One reason for having a large margin of safety was because the shells of the boilers were bent hot, and part of the plate was heated in the furnace while the other was cooled. Now, as far as I know, the ordinary good practice of the best boiler makers in this country is that the whole of the shells are bent cold, and in good practice never heated at all, so that the point of the fall in the elasticity—the elastic point of steel from 14 to 11 becomes a highly important one in view of the proposition which Mr. Sennett has brought before us. If it is so entirely, it goes a very long way to modify the opinions that we might form upon it. Now, as far as boiler shells are concerned, it strikes me that within a very considerable limit and quite as large a limit as is proposed by Mr. Sennett, they might be allowed to take care of themselves. I think that if any grave accident from accumulation of pressure was imminent, relief would be got in the way Mr. Cowper pointed out, by leakage through the seams, and not by an explosion of the material if that material were good in the commencement. I think he gave us an instance this morning of a very large rise of pressure in an experimental case where that did not take place. That is the experience of everyone who has endeavoured to make proofs of boilers with pressures under steam, however largely above the amount at which they were intended to work. No direct fracture takes place, but leakage to a considerable extent through the rivets, which act as a species of safety valve improvised for the moment. I consequently think that we have in that point of view an element of safety which is too frequently disregarded when we come to consider the possibility of maximum strains under pressure.

Mr. A. E. SEATON—My lord, I should not have taken part in this discussion were I not somewhat committed to Mr. Sennett's policy, inasmuch as some years ago I published a proposition for determining the thickness of shell plating, that had in it almost the same elements as Mr. Sennett's. My proposition was to considerably decrease the factor of safety, and to add to the thickness, or to determine constant quantity, to allow for corrosion or wear or tear of any kind; so that my proposition in the end comes pretty much to what Mr. Sennett proposes. I think Mr. Sennett's paper has been a very important one and a very interesting one, and is in itself a very good paper; but perhaps its chief merit is that it has elicited to-day a most valuable discussion, and has caused a great diversity of opinion to be expressed by the members of this Institution. Now, a gallant admiral yesterday intimated that it was almost the rule in Her Majesty's service for no two naval officers to agree as to what is the best thing for a ship. It seems to me that very few marine engineers can agree as to what is the best thing for a ship's boiler. We have had the opinion of the engineer-in-chief of the Navy, and I am rather sorry that this discussion to-day has taken a direction that was not intended. The proposition before the meeting was, I take it, this—was it advisable to determine the thickness of shell plating of the boiler of a war ship by the rules laid down by Mr. Sennett, and followed in Her Majesty's service, or those laid down by Lloyd's or the Board of Trade. Now, the question has become a very wide one to-day, and if I can bring it back to its proper channel I shall not have spoken in vain. Mr. Sennett has in his paper stuck pretty clearly to the question of shell plating, and I think we should do the same; because although we may be interested in all other questions relating to boilers, the question that we want to thresh out is that of shell plating. Now, Mr. Sennett has been somewhat roughly handled by one or two members of this Institution on that very question, and if I could say anything that would help him I should be only too glad, because I feel somewhat in the same boat with him. The question of a boiler in a war ship is very different from the question of a boiler in a merchant ship. In the first place the merchant ship is, as Mr. Taylor mentioned, at least 50 per cent. of her time under full pressure. In Her Majesty's service I should say that seldom happens, and is not likely to happen. The full boiler pressure is only measured at times and for short times, but still perhaps that is rather begging the question, inasmuch as she might be required to maintain the pressure for as long a time as a merchant ship, so I will not press that point, although it is one that should, I think, have some consideration in dealing with the question. During every year I have under my notice some hundreds of old boilers in their disintegrated state—that is, taken to pieces, so that we can thoroughly examine them. The result of that experience is this, that I do not think 5 per cent. of the boilers so broken up are condemned on account of shell plating. I have frequently heard the question canvassed, both by the owner of ships and the superintendent engineer, whether a new inside should not be put into a boiler that was already 10 or 11 years old. Mr. Reynolds called attention to the fact that he had seen shell plating in discarded boilers as good as on the day when it was put into the boiler. That is common experience. That is almost invariably the case. The part of the shell that does deteriorate, and sometimes rapidly, is near the front of the boiler, and this arises more from carelessness than from any inherent defect. The shell plate of a boiler with something like accuracy of stress put upon it is perhaps the only part that we determine by calculation, and therein I quite agree with Mr. Sennett. Mr. Parker's speech has, I take it, strongly strengthened Mr. Sennett's position, because he used the very strongest argument against thick plates; and as I listened to him I thought he was unintentionally backing up Mr. Sennett thoroughly in the reduction of factor, because he was telling us that the 1¼ in. plates were not to be relied upon for many reasons. I do not quite follow Mr. Adamson in his theories as to what steel does while being made, but we do know that a 1¼ in. plate does not give us confidence that a ¼ in. thickness does. Therefore, any tendency to thin the plates of the shell is working in the direction of giving greater confidence than we have. Therefore, I say it is better to have, and to feel that we have, confidence in a plate, say 1 in. thick, than to put a 1¼ in. plate, as Mr. Kirk has pointed out in the case of the *Livadia*, and have no confidence in it whatever. Then again as to deterioration. Under the present practice the nominal strength of joint is something like 80 to 84 per cent. with treble riveted butt straps. Now, Mr. Sennett, I take it, is not at all dealing with the question of a lapped joint, and, therefore, such fine points as Mr. Adamson raised about a boiler attempting to get into the exact cylindrical form, and therefore causing mechanical work at the bend of the plate, and that resulting in longitudinal corrosion, are beside the question. Therefore, I do not think we need deal with that, because Mr. Sennett's rule is I know to have double butted straps. Now my experience with double butted straps is this, that you begin with a thickness of plating, that is to say, the straps themselves are in excess of what is nominally required to equal the sectional area of the rivet. We know sectional rivet never decreases; you always have the same quantity in sheer at the end of ten years as you had the first day the boiler was put to work. The deterioration that occurs from the butt strap is, according to my observations, very slight as a rule, in many cases hardly perceptible, and even where there was deterioration the remaining part is more than necessary for the

nominal strength of the joint. Then since the shell plating itself is something like 22 to 25 per cent. in excess of the strength of the joint, you have there a very good margin of safety for deteriority or corrosion to begin with, so that I think we may very easily and safely cut down the thickness of our shell plating, and that with advantage beyond the thickness Mr. Parker has named, that is to say, 1¼ in. Now the example given by Mr. Parker was hardly a fair one, because he spoke of the single ended boilers of very moderate size. Now when you come to boilers of 15 ft. in diameter and 18 ft. long, and a working pressure of 150 tons, the question is a very serious one for many makers of marine boilers. In the first instance the means of dealing with those heavy plates is limited, that is to say, the old boiler shops have not rails capable of dealing with them properly; they have not auxiliary cranes for lifting them and carrying them about the works, so that the extra thickness there handicaps the maker at the outset. Then again, when the boiler is completed and has to be lifted into the ship, there were until recently very few ports that have lifting appliances above 50 tons. It is very true that the necessities of marine engineers have led the dock companies and themselves into laying down very much heavier plant for lifting, but that was within a very recent period a very great difficulty. Now the question of the application of this rule to mercantile purposes may be considered, and in the first place I would beg to point out that the shipowner is scarcely the man to speak on this subject. He is about as competent to speak on the thickness of his boiler plates as Mr. Parker's committee is to determine a vexed question which Mr. Kirk might put before them. I think it would after all come to Mr. Parker on the one hand and the superintendent engineer on the other. I know we have to-day a very large sprinkling of superintendent engineers here, and, therefore, they are a jury quite competent to deal with the question without reference to their employers. A statement was made it is quite true—I think it was made by Mr. Kirk—that however well you may make the boiler, whether by Mr. Sennett's rule, or by Mr. Parker's rule, or by Mr. Traill's rule, if the boiler is not put into the hands of competent men and properly treated, the result is always the same, and that is that you get within a very short time a leaky boiler, and you get constant complaints; it does not matter how carefully the joints have been drilled and riveted, and you get a short-lived boiler. Now that is not the fault of the manufacturing engineer, and it is not the fault of Mr. Parker, or Mr. Traill, or Mr. Sennett, but it is the stinginess—I think that was the word that was used—of the shipowner in not giving some premium to good men for the care they will devote to valuable machinery. Now if the shipowners will deal with that question, and that is something beyond the superintending engineer, I think he will be performing his proper function, but when it comes to asking him whether he will have a thick or a thin plate, he will probably ask you which costs the most money, and if you tell him the thick plate costs the least he will have the thick plate; because generally the shipowner (and naturally) has to judge of these things from the money point of view. That is his standard of measurement. I quite agree with what Mr. Cowper said as to the elastic limit being the proper consideration for fixing any rules. I was a little surprised at what Mr. Parker said about the change in elastic limit, but I think his explanation has put that in a different light altogether. If you take a shell plate of a boiler and bend it into a circular form cold, and then bend it back again to test it, you must not be surprised if you find some slight changes in its structure, but I do not think the same thing would have happened if it had been a thin plate that Mr. Parker spoke of or in the case of a thick plate if it had been heated to the proper temperature for that purpose. There is no doubt that if we are to cut things fine we ought to know accurately the elastic limit of the material we are dealing with, and therein I think Mr. Sennett will quite agree with me, because, for the purpose of this paper, I know that he has assumed that it is roughly about half the ultimate strength, but at all events that is a question that can be very easily settled, because the boiler plates are tested, and by the modern testing machines it is just as easy to find the limit of elasticity as the ultimate strength, there is no more trouble required nor expense. Now there is an important point that has come up to-day, and one that bears on this question. We are accustomed to test all our boilers with water from the mains, or from the dock, as the case may be, at a temperature varying from 35 to about 55 or 60. Now what the result would be if we tested the boiler with water at, say, 212° is, I think, quite another matter, and I am strongly of the opinion that the cold water test is not sufficient, because I have seen instances in which a boiler under the water test has proved itself to be a thoroughly sound and well made boiler, and not the slightest leakage has taken place, not even the traditional spoonful, whereas that very boiler on getting up steam has shown signs of leakage, and if not attended to the leakage has been sufficient to be spoken of and complained about. Now I do not know that the increase of the temperature would improve our boiler making, but I seriously think it would open our eyes somewhat to the complex nature of the strains that come on the material under ordinary working conditions. The worst treatment I know for marine boilers is that of getting up steam rapidly with no means of circulating. It is then a question of strain on the shell. If you heat very rapidly the top of the boiler and the bottom remains cold, while it does not require any proof or experiment of any kind to show that there must be a very serious strain set up in some parts with the result of the most carefully made joint being started. We cannot help that. If marine superintendents will not take precautions to prevent such a thing, neither rules nor regulations, nor good machinery nor careful design will get over it. Professor Kennedy has spoken of testing rivets, or rather of the extraordinary results he got from rivet tests. Now that is quite contrary to my experience, and I may say that in our boiler making we test rivets for Lloyd's and Board of Trade Surveyors at the works, and these are taken at haphazard from the rivet bags as they come in, and, therefore, I do not think it is possible in practice for there to be such wide differences as he has spoken of. I am sorry I have trespassed so much upon your time—time flies very rapidly when once one begins talking, but I thank you for the patient hearing you have given me, and I again thank Mr. Sennett for myself for the excellent paper he has given us.

Mr. List—My lord and gentlemen, the few remarks I wish to make on this subject are from a point view of a superintendent engineer having a large number of high-pressure boilers under his charge. The class of boiler that I am particularly speaking of is a double-ended boiler up to 15 ft. diameter and 19 ft. long. My experience of the working and care of these boilers is that, in the hands of first-class men there is practically no trouble. Internal corrosion underneath should be avoided by proper care and painting. Corrosion on the top is practically prevented by the non-conducting composition; but there is, of course, the risk that if you have a leaky seam under the covering, considerable corrosion may go on; but in most cases that will be shown by the covering becoming destroyed. Mr. Sennett has brought forward this paper, I take it, with a view to get the opinions of engineers as to the desirability of reducing the strength of the shells. Mr. Sennett's position is entirely different from that of the engineers of Lloyd's Registry, or the Board of Trade, or the engineers of the commercial marine, which is at present a very difficult thing to do, that is, to produce great power in a very small weight; and if I may offer the opinion of an outsider, I think that weight is a great deal too much cut down; but that is a matter between the naval architect and the marine engineer. No doubt as long as the weight is cut down to the present point the marine engineer will make the machinery to do it; but as to the machinery lasting as it is supposed to do in the mercantile marine, that is a thing we do not know so much about. When it comes to the question whether the mercantile marine should cut down the weight of the shells, as the Admiralty propose to do, and test to only 90 lbs. above the working pressure, I think we ought to proceed very carefully in that matter. The Admiralty have, no doubt, first-rate men, and their boilers are well taken care of; so are the Mail Boat Company's; but the Lloyd's and the Board of Trade also have to deal with many ships where boilers are not so well taken care of, and if you take some of the cargo traffic, which has few enough engineers for the work to be done, and not a very big outfit, and everything cut down to the most economical point, then in this case the boilers are not worked as carefully as they ought to be, and I think Lloyd's and the Board of Trade are quite right to retain a considerable margin of safety. But I think that we might go a little in the direction of cutting down the strength of the shell. I think the shell is at present stronger than is necessary; but I think we should proceed in that direction carefully.

Mr. Corrie—My lord, I rise with some diffidence, as I happen to be both a shipowner and a member of Lloyd's Committee—two classes that Mr. Seaton seems to treat with not much respect, at least in his opinion. However, it is a question that I have considered somewhat, and perhaps from a shipowner's point of view I may state it. I know the feeling of shipowners generally is that the boilers should be beyond exception. There should be no doubt at all about them. Whatever reduction of weight there may be in the rest of their ships, they would not like to run any risk or to risk the lives of their employés by reducing the strength of the boilers. I think the fact has been very clearly pointed out that the conditions of working on board the mercantile marine

and on board the navy are very different. As it has been said, in a mercantile vessel the boiler is kept at its full pressure full power half the year, which is quite an exception on board H.M.'s vessels; and from the occasional accounts we have of trial trips in H.M.'s service, I do not think that their practice seems to be any better than in the merchant marine. That is, we hear of more accidents and more putting back. Of course the boilers are tested to a greater extent than is ever done in the mercantile marine; but still they seem to be tested up to their full power, and a good many accidents, no doubt, occur. With regard to my position as a member of Lloyd's Committee, of course, we naturally look to the safety of the structures that we superintend, and we require to be very careful indeed to see that the structures are fairly within reasonable limits. I think, going into the question of the strength of the material, this factor of safety that has been put before us, 4 and 5 and 6 is very misleading. I hold that there is no such factor in existence. The factor of safety is practically the elastic limit. Once you exceed that, your structure, as a boiler, is destroyed. If you once begin to leak, of course, your boiler may be theoretically able to stand the high pressure, but it will not, and therefore, as a structure, it is practically destroyed. No doubt, as we know, the elastic limit does not arise in proportion to the normal ultimate strength of the material. It may be 40 tons and the elastic limit may be, perhaps, 14 or 15 lbs., and at 30 it may be very little different or slightly different, so that to take the ulimate strength of the material as an absolute standard, I think, is misleading, because, after all, it is the elastic limit that is the point to be determined. Once you exceed that, your structure, as a marine structure, as a boiler structure, certainly is destroyed. We know that looking at it in that light, the margin of safety, even in our present structures, is not more than 2½, or certainly under 3. However, as I said before, the practice of the Admiralty and the practice of the mercantile marine, are very different. I would not attempt to condemn the practice of the Admiralty, but it must not be taken as a standard for the rules to be adopted in the mercantile marine.

Mr. McFarlane Gray—There is no need for anyone to speak upon this, because there has been so much said already, and I think we all concur very much in it. Mr. Sennett's position is very different from that of the Board of Trade or of Lloyd's; and I think that we ought to sympathise very much with him in his position, but he is doing the best that he can. I hope that he is not going beyond what the other people are doing who are likely to be our enemies some day. If the pressure is increased so much in our boilers, we must remember that the rate at which the pressure increases when you get to high pressure is very much faster than it is when you are at low pressures. Take a boiler, say at 30 lbs. pressure, but increased to double its pressure by negligence—take the case of the *Thunderer*, for instance—the advantage of a margin is to give people time to find out that there is something wrong. Now, the boiler did not want to burst in the *Thunderer*; it did not burst for a long time; it was going wrong all the time, and giving the engineers time; it was trying to hint that something was going wrong, and they did not see it. Boilers do not burst in that way. As to the elastic limit. A captain called upon me some years ago to tell me how his boiler had burst. Now, this was a boiler which burst at, it must have been, 250 lbs. or 300 lbs.; it blew off the steam dome. What was done with it? It must have been surely past the elastic limit, it must have been at 250 lbs. or 300 lbs. pressure. I saw the dome afterwards. They put on a new dome, and I suppose the steamer is running now. Where is the elastic limit in the case? There has been a good deal spoken about elastic limit that I do not believe in; at least, if what we have heard is true the books require to be re-written about it, because all the authorities that speak of the elastic limit, to my knowledge, say that the more work you put upon iron the higher is the elastic limit; you raise the elastic limit by putting more work upon it. I think that to get frightened at this elastic limit is wrong, because, in this matter, it is well to consider this, that if you hurt a boiler by putting the iron past its elastic limit—as it used to be said long ago—that you broke its heart; if you put more weight upon a chain than it could bear, that, it is said, ought to apply also to boilers. But suppose that is not the case, and that it is not hurt by passing the elastic limit (and I, for one, do not believe it is hurt) then what I say is this: It is of great importance for all steamship owners and shipping for the Admiralty, if they have a boat upon a foreign station, and they would have to bring it home to get new boilers, that they should be able to test the boiler up to a certain pressure at that spot where the ship is. Let them test the boiler up to a certain pressure. I do not care whether it is past the elastic limit or not, and if they see that some part has not been doing its duty properly, repair it on the spot. That would be a very great advantage in the case of ships on foreign stations, and it is a great advantage everywhere to be able to see to your boiler while the ship is lying in port, to test it when it begins to leak, and repair it as it requires. I say in the case of a boiler that is tight for five minutes after a certain pressure, I would be quite willing to work 40 per cent. of the pressure, and very often 40 per cent. of the pressure would be all that was wanted.

Mr. Yeo—My lord and gentlemen: — I ought, perhaps, to apologise for attempting to speak here on such a subject as this. My object is to bring out an extremely simple and elementary view of the matter, and one that I think, so far as I understand it, has been adopted to some extent in the paper, that is to say, with regard to the various circumstances that may produce injury. Most, if not all, of these exist with boilers carrying low pressure. As to corrosion, for example, we know there is no more corrosion at the present time, but a good deal less corrosion than there was a few years ago, and with regard to difference of temperatures in different parts of the boilers, that also existed in low-pressure boilers, so it may be just worth while, looking simply at the question whether this margin produced by a test of boilers at 90 lbs. above the working load does not really provide as large a margin of safety as was found and proved by experience to be sufficient in the case of the old low-pressure boilers. If you imagine a boiler to be isolated from the rest of the boilers that it is working with, and imagine further that its safety valves are set fast in their settings just at the time when they ought to rise, that is to say when the pressure reaches and passes the blowing off point, and imagine further that this happens without being observed, there you have the very circumstances, or at least one of the important contingencies, contemplated in providing a margin of safety. Under these circumstances it becomes worth while, perhaps, to inquire what effect a given amount of evaporation (supposing there is evaporation going on at the same rate as before) will produce in increasing the pressure in the boiler and so encroaching upon, and presently extending, the margin that has been provided. If you take any given capacity of steam chest the ratio in which the pressure will be increased by any given amount of evaporation will depend on the pressure you have there already, that is to say, if you have a high pressure of the boiler and you add to the steam already in the steam chest a certain quantity by evaporation would increase that in a certain ratio; but that ratio is very small compared with what would be the case if the boiler had had in the same steam chest (I am supposing other things to be the same) a smaller pressure, you would have a much greater increase relatively to pressure, that is assuming the capacities of the same chest are the same. Of course, we know as a matter of fact the present high pressure boilers have not so large steam chests in proportion to the working surface as was the case formerly, but even making the allowance for that, if the smaller steam chest is taken into account it still remains the fact that in the circumstances I have supposed, that is to say, with some steam being produced and the safety valves not blowing off, the effect produced by increase of pressure in the high-pressure boiler would be raised relatively than would be the case in the low-pressure boiler. Coming to figures, roughly comparing a boiler carrying a pressure of say 150 lbs. with, to take an extreme case, an old low pressure boiler carrying say 30 lbs. pressure, the evaporation that would be sufficient to double the working pressure in the low-pressure boiler, and therefore you entirely exhaust the margin provided which would be sufficient only in the case of the high-pressure boiler to raise the pressure by about 50 or 60 lbs., speaking in round numbers. In fact, a boiler of 150-lbs pressure with this margin that is contemplated in the paper is really so far as this which I will confess is a partial and incomplete way of looking at it—it is not complete, but still it is perhaps worth something—in much the same position as a boiler at 60 lbs. pressure tested up to double the working pressure in very much the same position with very much the same margin. Therefore, at present, looking at it from that simple point of view I am not supposing for a moment that this takes into account all other matters, but still it would appear that from that consideration alone as regards the strength of the boiler to resist an increase of pressure which has not been intended, the margin provided in the present boiler by testing up to 90 lbs. above the working pressure is really a larger or at least as large a margin as was put up with and found to answer practically while the steam pressure was very low.

Mr. McFarlane Gray—I wish to interpose one word of explanation! I am told that I was misunderstood. I am told that I said that I wished that the boiler should be tested to two and a half times the working pressure on every occasion. Not at all.

What I mean is this. Is a boiler to be ruined? It is a question whether you are to use that boiler at all or lose it altogether? Then, I say that, however bad a boiler is, if you repeatedly test it and repair it, I would trust myself upon that boiler at 40 per cent. of the pressure. I did not at all mean to test it to two-and-half times the working pressure.

Mr. White—I feel I must apologise to some extent for speaking on a purely theoretical matter, but it is a matter with which I am necessarily intimately concerned, and further than that it is a matter which grows out of a discussion in Newcastle, where in the absence of my friend Mr. Sennett I ventured to say that I thought what we were doing at the Admiralty was both scientific and safe. I have listened to nearly all the discussion to-day, and the impression made on my mind is this: that not a single speaker has attempted to defend the position which Mr. Sennett in his paper assails; that there is real justification or necessity for a test pressure of double the working pressure of any boiler. I may have misconceived the utterances of gentlemen who have spoken, and I had not the advantage of hearing Mr. Parker's speech, so that if he said that he defended that, then I can only say that no other speaker did continuously in his speech; he may have set out by doing it, but not continuously defending it. Now, I noted these facts, that Mr. Cowper, who seemed to set out defending the position, ended by saying that in his own practice he was content with 50 per cent. above the working pressure in the cases which he gave. Mr. Adamson gave us a case based upon his large experience, and I think I am right in saying that he took 40 per cent. above the working pressure, as the test which he applied. Mr. Stromeyer, in a power of selection which did him credit, but which I think would be rather special to himself, proposed to apply the test of 50 per cent. above the working pressure to old boilers, but to leave new boilers, I believe, much as they are now. Now, I do not pretend to be able to distinguish between a new boiler and an old boiler. If we were inclined to reduce the test at all, I should be inclined to do that on the new boiler rather than on the old.

Mr. Stromeyer—It was with reference to the joints of the boiler, not the boiler itself. An old boiler with all the numerous joints and all the pipes fixed is sure to leak, as sure as you come above pressure and a half. Some of those give way. They are quite good enough in themselves, but the boiler itself would easily stand the double pressure.

Mr. White—I am very thankful for Mr. Stromeyer's explanation, which leads me to this point at once—what is this hydraulic test applied for—what is meant by the testing of the boilers? I am bound to say that, from a great deal that has been spoken here to-day, one might expect that hydraulic testing of boilers gave you an assurance of safety, an assurance of safety which nothing else could give. Of course I know perfectly well that no one here who claims to be an engineer holds such an opinion, but that is the fair inference from a great deal that has been said. Now, so far as I understand the testing of boilers in its present application, it comes to this, that it is a test of imperfect workmanship. It is summed up in that. It is well to break away these misconceptions and to come to the point. Now the point is, how are we to get a reasonable assurance of safety under the working conditions of a boiler? That is really the point we want to settle. Mr. Sennett comes forward and says—and I perfectly agree with him—that the method which Mr. Kirk described as the method of multiplication, must be given up. We have the assurance of some of the leading men in the profession here to-day, that, in their opinion and practice, they have given it up. We have had the concurrence of some of the leading marine engineers in the country to-day, that Mr. Sennett's proposed alternative is reasonable and may be accepted. Of course we do not come here—Mr. Sennett does not come here—as being primarily responsible to ask this Institution to say that what he has done is right. He takes his professional responsibility on his own shoulders, and in my measure I share it with him. We do not come to the Institution of Naval Architects to ask for the assurance that we are right. There are lots of boilers making all over the country in accordance with this rule which—with all respect to Admiral De Horsey and to his remarks, to which I hope again to allude to hereafter as to the boilers of the past—will go into Her Majesty's ships and will, we feel assured, have an ample margin of safety, and will I am quite convinced, if we should meet here again in five or six years' time, be made the subject of a paper from Mr. Sennett to show how excellent in their working the boilers made under this rule have been. There is one significant circumstance, my lord, to which I wish to draw your attention. It is this. There has not been to-day a single speech from an engineer who has been in full possession of an Admiralty specification of one of these new boilers who has not been in distinct agreement with Mr. Sennett's proposition. We have had on the other side abstract opinions not based upon the consideration of detailed specifications. That is a point which I commend to the notice of the Institution. Professor Kennedy with studied moderation (I am glad he explained the moderation) gave us what he called the plain English of some of these proposals, and he seemed to think that really the Admiralty were prepared, for the sake of saving a few tons weight, to run risks. I beg to assure Professor Kennedy that that is not at all the position which we assume in this measure. I also wish to assure him that I think our engineering staff at the Admiralty is conversant, not merely with experimental investigations so far as they have gone, but also with the theory of boiler construction, that they are perfectly capable of making their own calculations, and that I am perfectly convinced that Mr. Sennett would not have committed himself to anything which did not on the face of those calculations give him complete satisfaction as to the sufficiency of his margin. We have had figures given by Professor Kennedy; of course we do not know his method of calculation. We all know his ability to make those calculations, but without studying their detail as well as the results, it is impossible to attach much importance to those figures. A boiler, as Mr. McFarlane Gray very properly pointed out, is a complex structure, and to apply calculation apart from experience to such a structure, is at all events a somewhat doubtful procedure. That may be made an argument for increasing the margin—the fact that we know so little about it. Really, if all the dreadful things that we have heard about boilers to-day were realities, I should be afraid to go to sea over one again, but I take my stand with the greatest comfort over the boilers in torpedo boats or many other Government vessels, and I am not at all supported in the position by my knowledge that there has been a hydraulic test, but by the fact that the people who designed the boilers and built them have the capability of doing their own business in a manner that is satisfactory. One word, my lord, if I might add it, and it is a very important one on public grounds. Admiral De Horsey, as I entered the room, was making some remarks on the unsatisfactory nature of the boilers at present in H.M.'s ships and their break-down under trial. He was also hoping that Mr. Sennett might not have reason to regret the step that has been taken. I have already alluded to the fact that this meeting and the public may be fully assured that no step has been taken that has not been well considered on the side of safety. I wish to say that to speak of the boilers in the Navy in the past as having been such grotesque failures, which I think is not an unfair description of the statements which Admiral De Horsey made, is, in my judgment, to go beyond the facts—much beyond the facts. As to difficulties occurring in the Navy, the nature of the service in the past has been altogether different from that of the merchant service. As Admiral Colomb well reminded me, while Admiral De Horsey was speaking, in the days gone when sail was largely used, the greatest difficulty which the Engineer of the complements of ships in the Navy was how to manage the boilers with fires banked up perhaps for a long period and then a demand made for steam. The conditions in the Mercantile Marine are altogether different. The works there are worked under fairly constant conditions; but in the Navy in later years there has been of course a much closer approximation to mercantile conditions owing to the disuse of sails. In a great number of the ships in the Navy now sail power is either wanting or else so small as not to count. The boilers are under steam, and Mr. Sennett could tell us if he would how well the boilers of the Navy have in recent years behaved, and how well preserved they have been. We have cases of ships which after 12 years' continuous service have run their trials abroad with their own complements, and made a good speed as well as they did on the measured mile in England. Then, if I may repeat what I said the other day at the United Service Institution, in recent times orders sent to all parts of the world without preparation, with no special additions to the complement, have resulted in a ships proceeding to steam for four days and nights continuously, and in those trials the power developed with the ships' own complements under service conditions has reached from 70 to 100 per cent. of the measured mile result.

Mr. Sennett, replying on the discussion said, my lord and gentlemen, whatever merits or demerits this paper may have had, it certainly has had the effect of producing a very interesting and, I hope, instructive discussion. The speakers who have joined in this discussion have been so numerous that it will be probably more convenient if I attempt to reply generally to the discussion rather than to the remarks of individual speakers. It does seem to me that the discussion to a great extent, as Mr. Seaton said, drifted from the main object of this paper. This paper was not written with any desire,

as I clearly stated, to raise the question of Lloyd's rules or the Board of Trade rules, but simply to state the principle which we consider—or rather I consider, for I will take the responsibility of it—the principle which should be applied to marine boilers, and which I think should be applied to all structures in which the forces acting upon them, and the material of which they are constructed are known. That case is pre-eminently the case of the shell plates of naval boilers. We have it from the speakers who have discussed this question, that large factors of safety that seem to be fancied in some places are simply due to the fact that they have to provide for unknown quantities, rather bad material, bad workmanship, or corrosion, and I would say in passing with reference to a remark of Admiral De Horsey's when he spoke of the greater care and the greater efficiency of mercantile boilers over naval boilers, I should like him to look at these plates that Mr. Parker brings here as a specimen of the shell plates in boilers of the mercantile marine, and I know perfectly well that if Admiral De Horsey were in command of a squadron in which a boiler of that sort were found he would very soon try the chief engineer by court martial. Now, we come to the question of the safety of boilers, and I wish to explain most distinctly that we do not propose and we have not proposed in any way to reduce either the strength or the safety of boilers. Most of the gentlemen who appear to have had some hesitation about this have objected or demurred on the ground that we are proposing to reduce the safety of the boilers; and I think someone remarked that from the shipowners' point of view he would like to be perfectly sure that whatever else was wrong his boilers were right. Well, I can assure you that from the Admiralty point of view we are quite as anxious to see that our boilers are right as any other shipowners. The Admiralty stands in, I may say, the compound relation of shipowners and manufacturers and surveyors; so that we have the whole thing in our own hands. We have to be present during all the working, and you may be quite sure we should not advocate anything whatever that would interfere with or reduce in any way the strength of the boiler. Several gentlemen have pointed to the fact—I think Mr. Corrie of Lloyd's particularly mentioned it—that the ultimate strength is a wrong thing to base your boiler rules upon, and that the real thing was the elastic limit, and that when you have passed the elastic limit the boiler is damaged. Why, that is exactly what I say in my paper; that the rule that we have hitherto adopted does lead to the danger of testing your boilers beyond the elastic limit. We say that with the pressure we put on the boilers that is within the elastic limit, that is a pressure that can be applied as often as we like and continued as long as we like without in any way interfering with safety; and therefore that is a safe pressure that can be applied to the boiler. Surely, if a boiler is safe with a pressure of 245 lbs. on it—safe with that pressure applied as often as you like and maintained as long as you like—it is surely safe at a pressure of 155 lbs. What is there to make it otherwise? Some of the speakers have overlooked the fact that those regulations apply singly to the cylindrical shell plate. The internal parts, the parts that are affected by working and flanging, those parts are left entirely alone, that is to say, there is no reduction whatever in the strength of those parts; and as I mentioned in the paper, those parts really form the critical parts of the boiler. For some years the Admiralty made a rule, especially in the earlier days of cylindrical boilers, that out of all the boilers coming from ships, one or more should be burst by hydraulic pressure. I personally superintended the bursting of a very considerable number of these boilers, and afterwards saw the condition of the boilers when they were broken up. In every case it was the internal parts of those boilers that gave way. In no single instance that came under my observation did the shell plate show any sign of weakness, and I say now, that in many of these cases the shell plates, though nominally having a factor of safety of perhaps 5, and so on, actually have a factor of safety of below 4, owing to the fact that some of these boilers were made before the time when riveted seams were so carefully designed and constructed as they are now. Therefore the strength of a boiler, the same as the strength of any other structure, is only the strength of the weakest part, and while we retain our present form of boiler, our present form of furnace and combustion chambers, with the maximum thicknesses that it is considered wise or desirable to use with these parts, then I say any additional metal thrown into the shell plates is so much metal thrown away. My friend Mr. Parker has probably somewhat gone back, I should say, from the position he held on this subject in 1877. During that year a very remarkable paper, one of the first of the important papers on the strength of boilers that was read at this Institution, was read by Mr. Milton, who was then Mr. Parker's chief assistant, I presume, and I have no doubt we may assume that Mr. Milton's opinions at that time were concurred in at least by Mr. Parker. In Mr. Milton's paper, after some preliminary matter in which he speaks about the factors of safety of 8 and 4 and 3—there was a certain amount of confusion at the time—he said, "The Manchester Steam Users' Association, founded by Fairbairn, for the prevention of boiler explosions, consider that where boilers are well built and carefully examined periodically, a factor of safety of 4 is sufficient, and the correctness of these views is shown by the freedom from accidents in boilers guaranteed by them. But of course we are not warranted in concluding from this that the same factor would be sufficient for marine boilers, which often would not be subject to the same careful and systematic examinations as land boilers. The old-fashioned box boiler working at from 10 to 30 lbs. had only a factor of about 4, and yet the accidents which happened with this low factor of safety were quite as few in proportion to the number of boilers in use as with the higher factor of 6, which is about the present practice of the country, although at the same time improved appliances have enabled boiler makers to make better and more reliable work than formerly." I think we may assume from that that in 1877 at least Mr. Parker contemplated reducing the factor of safety to 3. I think I might say one thing with reference to corrosion, as so much importance seems to be laid upon that by some of the speakers, that is to say, in the way of putting on a high factor of safety to cover it. I maintain that a factor of safety is not the way to meet corrosion at all. The only way to meet corrosion is by careful management and examination, and that is the way we have dealt with it in the Royal Navy, and I believe it is the way in which it is dealt with in all the important steamship lines. Mr. List from his experience confirms that. I have a list here of a number of our ships taken at haphazard which have been going for 10 to 15 years, and by our rules these boilers are examined and tested twice a year; the thicknesses of the plates are ascertained by drilling small holes through them so as to be quite sure where we are, and I find the greatest reduction in any one is in a boiler where the plate is about 1¼ in. thick, where there was a reduction of ⅛ of an inch. As to bad workmanship, that must be prevented by inspection. Having taken all these precautions, having eliminated all these unknown qualities, what justification is there for keeping up another factor of safety to cover them? If you eliminate them in one way you do not need to allow for them in another. In conclusion, my lord, I would just say that Mr. Parker called my attention to what was apparently a mistake in the last paragraph of my paper. All I can say is this, it is apparently certain that it differs from the letter that Mr. Parker read. I do not know whether that statement referred to iron or steel boilers.

Mr. PARKER—Steel.

Mr. SENNETT—All I can say is that this statement, if it is wrong, is based upon the statements of some of the most eminent civil engineers. I am quite prepared to accept it on their testimony, and if it is wrong the responsibility is theirs. Sir Fredk. Bramwell's letter is published in our Transactions. I think Mr. Alfred Holt is a steamship owner, and we are told that steamship owners were all against it. But Mr. Alfred Holt in his paper read before the Institution of Civil Engineers in 1877 says, after criticising the regulations of the Board of Trade for marine boilers, "The eccentricities of the law is noticeable. Surely life on shore is as worth preserving as life at sea, yet no law governs the boilers of railway engines, and the public ride with perfect safety, as years' experience with thousands of instances has proved, upon a locomotive carrying 120 lbs. of steam, or a boiler which, if it was in a steamboat, would be restricted by law to about 40 lbs. In fact, if sea rules for boiler strengths were enforced on shore travelling would be intolerable." I just quote that to show that there was some justification for the statement in the paper that the rules that are applied to marine boilers are not applied to locomotive boilers, and that if they were it would mean a considerable reduction of working pressure in the locomotive. I would just add, in reply to some gentlemen who asked what our foreign friends are doing in reference to boilers, that I find the highly scientific staff of the French Admiralty have in principle the same rules for the testing of their boilers that we have in the British Admiralty. Gentlemen, I thank you all for the attention with which you have listened to me.

THE NOBLE CHAIRMAN—Gentlemen, I congratulate you with all my heart upon the most interesting and valuable debate that has ensued upon the reading of Mr. Sennett's paper. I have only just one or two observations, and they will be very short, if you will permit me to make them. I have followed this discussion with intense interest, because it does so happen that about four years ago I was charged by our Council with the duty of corres-

ponding with the Board of Trade upon this question—upon the strength of boiler plates. I shall make no reference to that correspondence. Mr. Chamberlain was at that time at the head of the Board of Trade, but what I tried to impress, and what I still lay great stress upon, is a protest against the application of an old rule, which might have been admirable, sound and safe in reference to old material, to an entirely new and different material. That is my first point, because the two rules are not practically applicable. I, myself, cannot attach any weight, and I do not think any of us ought to attach any weight to the argument that is derived from the use of bad material, because the responsibility of taking bad material must rest upon the user of that bad material, and, therefore, I entirely object to that part of the argument. We have to deal with the material that is used, and bad material, I think we have a right to assume, that no responsible or respectable shipowner would use. Therefore, I do not think that that is a very good argument, and I do not attach very much importance to it. But now there is another thing. A great deal of use has been made in this debate of the argument of saving of weight, and my friend, Admiral De Horsey, whom we always hear with respect, talked about the question of the saving of weight, which he said ought never to be taken into consideration by the shipowner, it was so small a matter.

Admiral De Horsey—In the case of boilers.

The Noble Chairman—In the case of boilers. I am talking of boilers. But Admiral De Horsey entirely forgot what is the most important consideration to the shipowner, viz., the saving of fuel, which is connected with the use of high pressure. That is a very important matter to consider, and that is really one of the most important questions that arises upon the discussion of the whole boiler question. Now, I also wish to point out this, because it is a very important consideration. This paper has been written by the Chief Engineer to the Admiralty. Now, I want to say this much—talking about responsibility, supposing that the Board of the Admiralty sanctioned the use of a material that might have been considered too light, what would be the responsibility resting upon the Board, and upon the back of the First Lord of the Admiralty, if it came out that an accident had occurred, and that the Board of the Admiralty had sanctioned the use of a material that was not of the safest description. There is a weight that attaches to the opinion of the Admiralty which, I think, ought to be considered. Depend upon it the responsibility would be brought home to the First Lord, and the costs that would attach to a conviction would be far heavier upon him than upon any shipowner in this country. That is worth considering, and, therefore, upon that ground I look upon the opinion of the Admiralty as one of immense value, and one that may be safely followed. But at the same time I am perfectly willing to admit on the other side of the argument, that the use of boilers in the Navy and the use of boilers in the merchant service may be different, because the discipline on board one of Her Majesty's ships may ensure that attention to the conditon of the boiler which you can hardly in reason expect in a cargo ship, we will say engaged in distant seas upon a long voyage. I think there are two sides to the question, both of which you may attach some weight to. Now, gentlemen, I will say no more. These are the points that have struck me rather forcibly in the course of this discussion, and I have asked your permission to state them. We have been told that this great question has been submitted to a jury, and a very select jury I think it is, but I am afraid we might shut them up for a whole night and we should not find that they would agree upon a verdict. At the same time, gentlemen, it is my duty now to express on your behalf our best thanks to Mr. Sennett for his most able paper, and I, having taken great interest in this Institution for a very long time, thank you, Mr. Sennett, and I am sure the Company will thank you for the admirable discussion and the valuable discussion that has followed upon your paper.

This concluded the discussion upon Mr. Sennett's paper.

A Large Tug-Boat.—The steamer *Retriever*, lately arrived at Cardiff, is one of the largest and most powerful tugs afloat, being 220 ft. long and 2,000 H.P. She has brought the large four masted ship, *West Lothian*, round from Dundee in seventy-two hours. She was built by Messrs. W. E. Thompson & Co. for Messrs. Turner, Morrison, & Co.'s fleet of towing and salvage steamers on the Hooghly.

[Great pressure on our space obliges us to hold over until next number the article on feed heaters, important papers read at the Institute of Naval Architects, some correspondence, etc.—Ed. M.E.]

SOAPSTONE PAINTS.

In our last issue there appeared a letter from Mr. F. C. Goodall, Surveyor of Shipping to the Trinity House, in which he called attention to the value of Chinese Soapstone as a basis for paints or compositions designed to prevent the rusting of steel and iron ships, or other structures. In our present issue will be found an interesting reply to Mr. Goodall's previous letter from Messrs. M. Holzapfel & Co., the well known paint manufacturers, of Newcastle and elsewhere. In this letter, while fully bearing out Mr. Goodall's high praises of Soapstone as a rust preventer, they call attention to the fact that they have been for some time experimenting with Soapstone as a base for their pigments, and so satisfied were they with the results that they have been led to protect their patent rights in the matter.

Without going so far as Messrs. Holzapfel do in their assertion that Soapstone will completely revolutionize the paint trade, yet we are of opinion that if all the merits claimed for it both by Messrs. Holzapfel and Mr. Goodall are hereafter borne out in practice that there is a great future before it. Briefly, we may say that Soapstone, or steatite, is a soft magnesian mineral found frequently in small contemporaneous veins in the south of England and Spain. It is extensively used in the arts and manufactures; whilst in China, from whence it is principally and most largely obtained, it is used in the construction of idols, and also for preserving structures built of sandstone, and other stones which are liable to disintegrate under atmospheric influences, and we are told that the covering of powdered Soapstone, in the form of paint, on some obelisks in China which were hewn out of stone liable to suffer under atmospheric influences, has been known to preserve the same intact for hundreds of years. Soapstone may therefore, we think, safely be said to possess extraordinary qualities in withstanding atmospheric influences, which have a great deal to do with the corrosion of steel and iron, for the inside of a steamer, which, although not exposed to the incessant action of salt water, like the bottom, corrodes much more quickly than the outside.

Ground Soapstone is one of the finest materials which can be produced, and Messrs. Holzapfel have found that nothing takes hold of the fibre of iron and steel so easily and firmly as Soapstone. It is, moreover, lighter than metallic pigments, and is said to cover a larger surface than either zinc white, read lead, or oxide of iron. As prepared by Messrs. Holzapfel, the Soapstone is mixed with a quick drying varnish of great tenacity and hardness, thus producing a paint of great covering capacity and firmness, which presents an enamel like surface of a bright red colour.

As Soapstone is neither effected by heat, by atmospheric influences, nor by ordinary acids, it possesses great advantages over the metallic pigments, and it may practically be considered an imperishable article.

The Soapstone composition will also preserve woodwork from rotting and sandstone from decay, and it will also render walls damp proof. We trust Messrs. Holzapfel may receive that measure of support which their enterprise entitles them to expect, and that their invention may prove as valuable to themselves as we have no doubt it will to the shipowning community

INJECTORS AND EJECTORS.

INJECTORS and ejectors have in many cases their advantages, although, for various reasons, they have not come into general use in marine engineering. There, however, appears to be no good reason why injectors should not form part of the marine boiler feeding arrangements, for as great an authority as Professor Rankine was of opinion that an injector "may be an useful appendage to a boiler, for the purpose of supplying water when the feed-pumps are not working." The same authority also stated it "is convenient because of its simplicity, and its needing no engine to work it." Further, it may be pointed out that the steam employed is returned to the boiler, that the feed water from an injector enters the boiler in a continuous stream, and that the first cost is less than a feed-pump, while the up-keep and repairs are of a *minimum* character.

It is therefore at first sight surprising that injectors have not entirely displaced feed pumps, more especially for marine purposes. Probably this might have occurred, had not there been instances in which injectors failed to do their work satisfactorily. Partly this was due to defects inherent to the ordinary injector, and partly also to the want of thorough knowledge of the conditions under which they can work. It must be remembered that for the efficient working of an injector a supply of dry steam is a *sine qua non*, and the temperature of the feed water must not in ordinary injectors exceed 130 degrees Fahrenheit, or 100 degrees in self-acting ones. Given these conditions, there appears to be a wide field of usefulness for injectors of an improved type, specially designed for their particular requirements.

Messrs. Gresham & Craven, of the Craven Iron Works, Ordsall Lane, Manchester, also of 60, Queen Victoria Street, London, E.C., have had a lengthened experience, and as a result have designed various modifications of the original Gifford's Injector, being convinced that no one

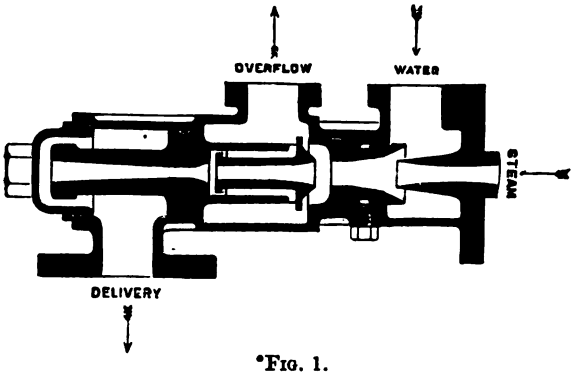


FIG. 1.

type of injector or ejector can possibly be suitable for al classes of work. In Figs. 1 and 2 we show sectional views of a new injector of their automatic type, which obviates the difficulties experienced with earlier injectors in marine boilers.

In construction this injector differs from ordinary forms chiefly in two particulars. First the water cone, or, as it is more generally termed, the combination cone, is in two parts, being divided transversely at about the middle of its length, the upper part being fixed and the lower half movable longitudinally through a small space: This movable piece is kept in place merely by webs, which, while preventing any lateral displacement, allow free longitudinal motion. The second chief point of difference is that the steam spindle is dispensed with, the inside diameter of the fixed part of the water cone being larger than the inside of the steam cone, and so allowing steam, when turned on, to freely pass away at the overflow, and by its inductive action causing a partial vacuum in the water pipe. This allows water to rise in this pipe, when, coming in immediate contact with the steam, the latter is at once condensed, and a continuous vacuum being formed in the combining cone, the action of the injector is started and the jet established. This is necessarily accompanied by a movement of the lower half of

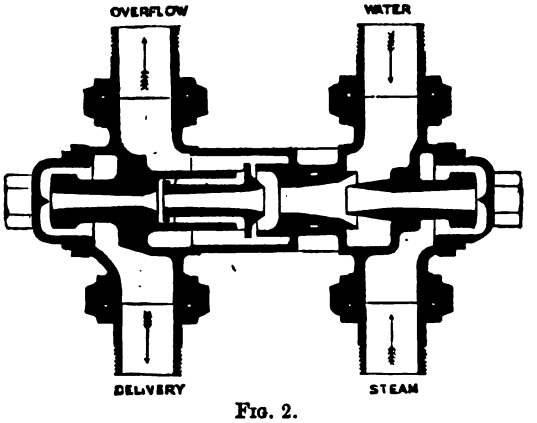


FIG. 2.

the divided cone, which, rising under the influence of the atmospheric pressure on the under side of its top flange, comes into close contact with the lower part of the upper half of the cone, and makes this divided cone practically one. Air is thus excluded from the jet, which passes direct to the throat at a higher velocity than that due to the overflow of water under the boiler pressure. The feeding jet can thus enter the boiler. Should the working of the injector cease from any cause, as, for instance, by the rolling of the vessel stopping the supply of water, the moving half of the cone at once retreats from contact with the fixed half, and opening a free way to the overflow, the same operations are repeated, and the injector starts automatically. Fig. 1 shows the arrangement of Gresham's Patent Self-acting Re-starting Injector with flanges, and Fig. 2 with screwed unions, and though both shown in a vertical position for convenience in describing, these injectors work equally well on any side or upside down. All parts are most accessible for inspection, and the cones can be easily taken out and cleaned without breaking any pipe joints.

Attention has already been directed to the conditions necessary for the successful working of these injectors. In addition, a back pressure valve must be placed on the delivery pipe, between the injector and the boiler; also a wheel valve, or cock, on the steam pipe, and a regulating cock on the water supply pipe. In Fig. 3 we illustrate one of Gresham's Patent Injectors equipped with steam spindle and water regulator.

If, as we have seen, injectors may under proper conditions be adopted advantageously in steam navigation,

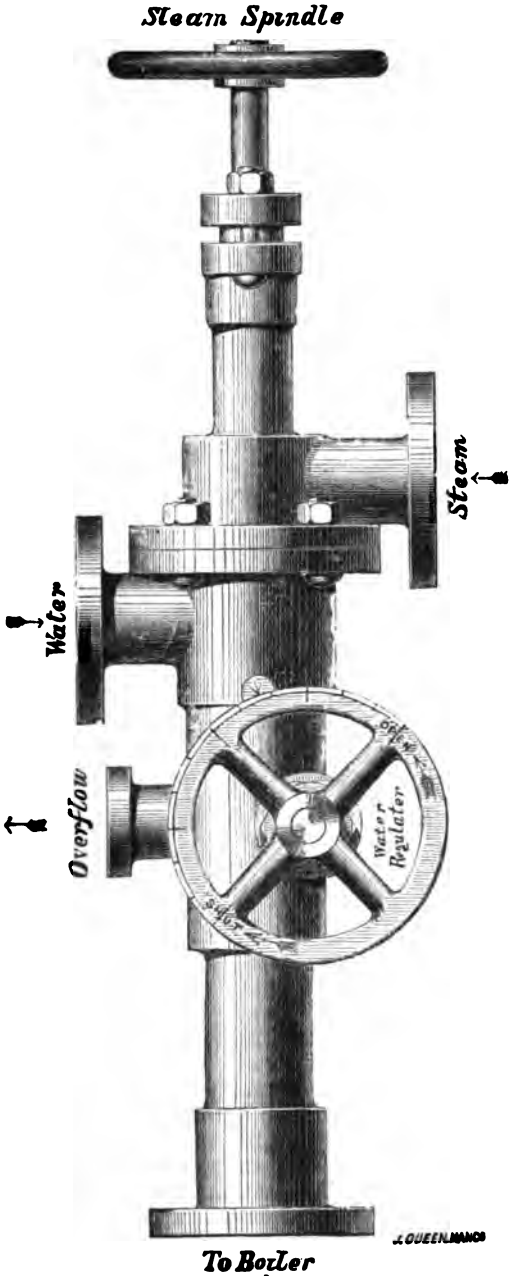


Fig. 3.

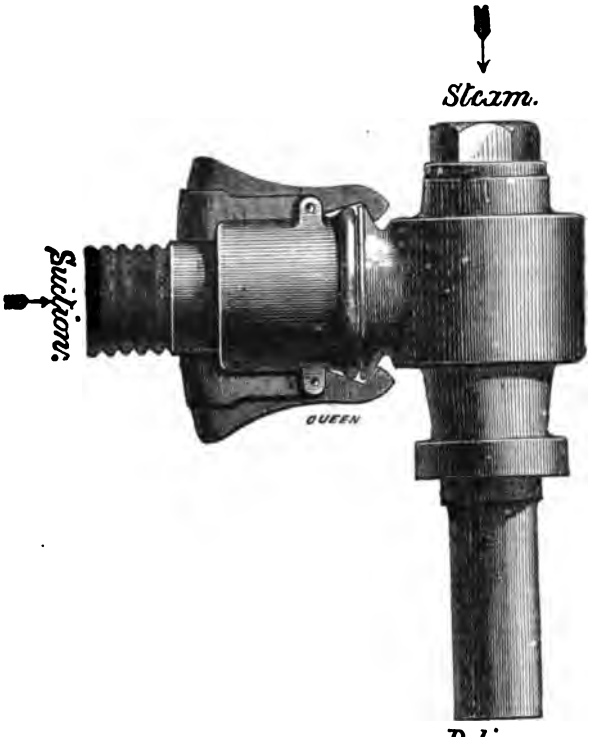


Fig. 5.

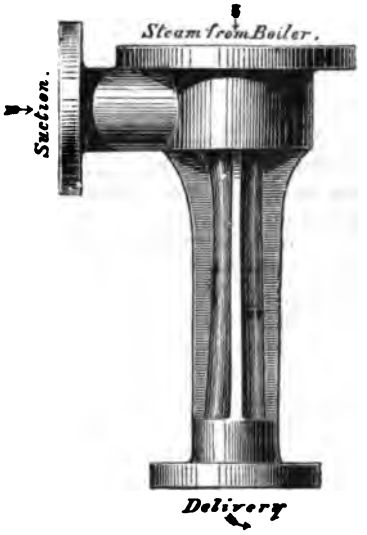


Fig. 4.

is there not also in vessels propelled by steam power available work for elevators or ejectors? Might they not at least be employed as supplementary to the ordinary bilge pumps, considering their simplicity and comparative inexpensiveness? Is it not advisable that in steam vessels carrying hundreds of passengers there should be even an *enormous reserve of power* for getting rid of water?

Ejectors such as those illustrated in Figs. 4 and 5 take up a very limited space, and have been constructed of steam to blow through for a few seconds, then it may be fully opened

In order to familiarize those of our readers who may not have seen ejectors placed on board ship, with the general arrangement of suctions, steam pipes, discharge pipes, and valves, we show, in Fig. 6, part of a cross-section of a steamer fitted with both of the forms of ejectors already illustrated. At A the method of fixing below the floor of the engine-room is shown; and at B that adopted when the ejector is placed above the floor.

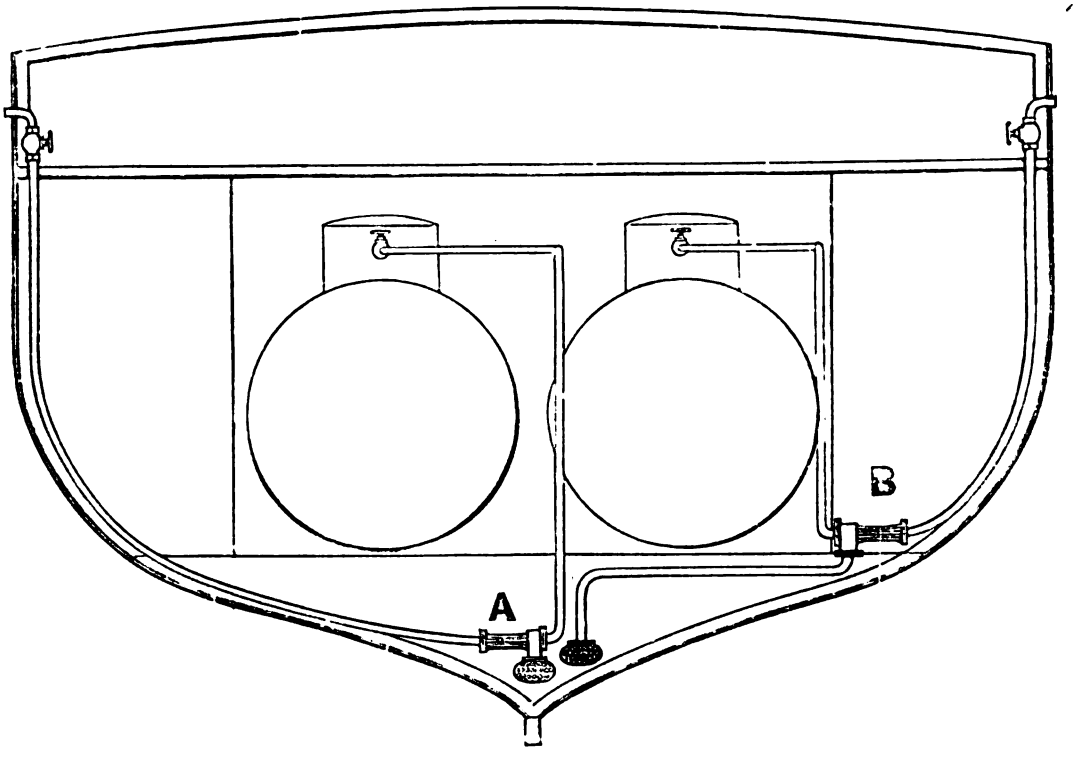


Fig. 6.

large sizes by Messrs. Gresham & Craven for steam vessels. The elevators illustrated in Fig. 4 may be placed either above or below the water supply; if above, the distance must not exceed 16 ft. They will force about one foot high for each lb. of steam pressure; and now that high pressure steam is so commonly employed in marine engineering, it will be manifest what a ready means these injectors afford—if fitted of sufficient number and sizes—for overcoming even the most serious leakages which usually result when two steam vessels come into collision. Fig. 5 shows the external appearance of Gresham's Patent Improved Water Lifter, which will lift or suck up water about 25 ft., and deliver a volume proportionate to the size of pipes and ejector, and the pressure of steam employed. It is scarcely necessary to point out that the suction pipe should have a rose fixed to the end of it, and that the air-tightness of the pipe is an absolute requirement. In working ejectors, elevators, and water lifters, at first the valve or cock on the steam pipe should be slightly opened to allow the condensed

Many other forms of injectors and ejectors are manufactured by Messrs. Gresham and Craven, but we have carefully restricted our remarks to those likely to be of special interest to marine engineers. The reputation of the makers in this class of work, as well as in vacuum automatic continuous brakes and passenger communications for railway trains, is such that no commendation is necessary. In closing we cannot but, however, observe that on a recent close inspection of a number of their specialities, we were highly gratified at the high class finish and careful workmanship everywhere observable.

Delta Metal.—We hear that Mr. Dick has formed his business into a company in order to enable him to better meet the greatly increased demand of his metal. Sir Edward Reed, the late Director of Naval Construction of the Admiralty, is the chairman, and Mr. Charles Cammell, of the Cyclops Works, Sheffield, and Mr. Bond, of Messrs. Vivian Younger & Bond, are Directors of the Company. Although the Company was registered only last month, nearly all the capital at present required has already been subscribed for by users of the Delta Metal.

WATER-TIGHT BULKHEADS.

THE importance of water-tight bulkheads cannot be overrated, and every year increasing attention is being devoted to the more effective sub-division of steam vessels, more especially those in the mail and passenger services. It is now the aim of several large steamship companies to build only "unsinkable" vessels, so far as human skill and forethought can secure such a desirable result. It is not, however, sufficient to divide the hull of a vessel into a large number of so-called water-tight compartments; it is also necessary to be absolutely certain of the reliability of the various divisions or bulkheads, under every possible circumstance. The structural arrangements, the plating, stiffening, riveting, and caulking have in recent years received greater attention, and largely owing to the increased stringency of the requirements of the Committee of Lloyd's Register, these important items appear to have been, at least in the majority of cases, made sufficient. There are, however, other important factors in the efficiency of bulkheads. Rarely is it possible to dispense with openings on these divisions—owing to the necessity of having cross bunkers, &c., and to the providing of efficient ventilation to the various holds and 'tween decks of large steamers. It is well known that a defective arrangement of coal-bunker doors was, in the case of the ill-fated *Oregon*, one of the principal causes of that vessel's loss. It therefore follows that any improvement in the construction and design of such *minutiæ* are deserving of attention. One of the most recent is McElroy's Patent Water-tight Bulkhead Doors, which in Figs. 1, 2, and 3 we illustrate. These doors, unlike those in the *Oregon*, are vertical, and are thus to our mind to be commended.

FIG. 1.

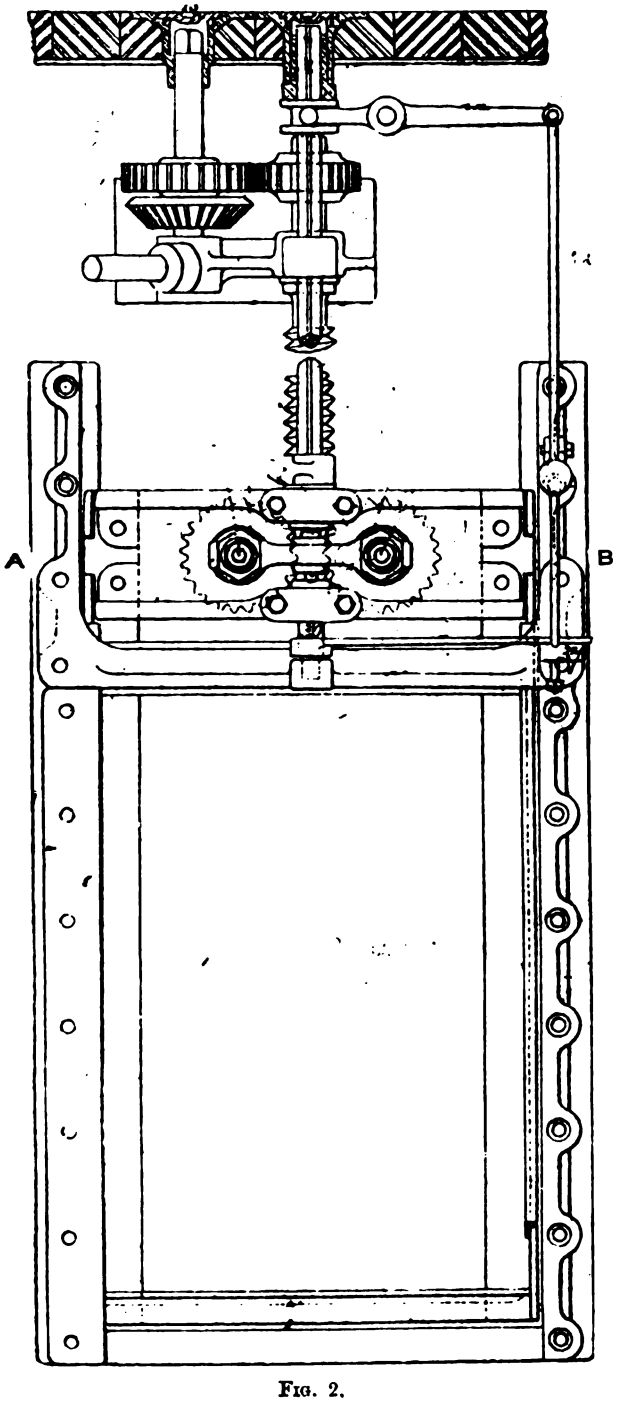


FIG. 2.

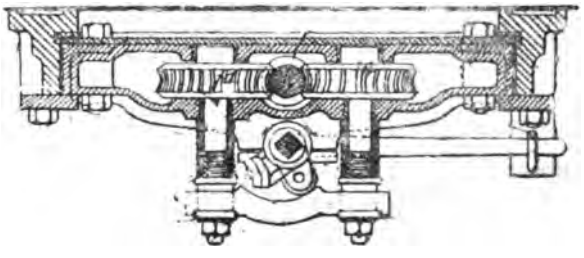


FIG. 3.

Fig. 1 shows a section through the upper or main deck to which the gearing for opening and closing the door is carried. Fig. 2 is a plan of the door, and Fig. 3 a section through A B in Fig. 2. It will be seen that the door is lifted by a vertical spindle geared into worm-wheels, one on each side, which when prevented from turning act like parts of a fixed nut, allowing the door to be moved in either direction by turning the screw spindle. Powerful springs in connection with the worm-pinions are provided so that the door may be closed as slowly as need be, while by means of a powerful lever-cam the worm pinions can be released from the vertical screw spindle, and the door closed instantaneously. This latter arrangement is all important, remembering the disastrous loss of the *Oregon*, and the only possible drawback is the danger of a door breaking by the sudden fall. On account of the high-class material used in their construction, this danger may, however, be safely dismissed from view, the sole licensees and makers in England, Messrs. Watson & Sons of Newcastle-on-Tyne, being deservedly well known for the high character of material and workmanship exhibited in their manufacture.

Of almost equal importance to having efficient water-tight doors, is the certainty that at all other openings in bulkheads, the efficiency of these structures is not im-

paired; and amongst the most important of what may be styled minor openings are those for the accommodation of ventilating shafts. Until recently the efficiency of

We commend these specialities to the notice of our shipowning and ship-building readers. Already they have been largely adopted, but we venture to say that as

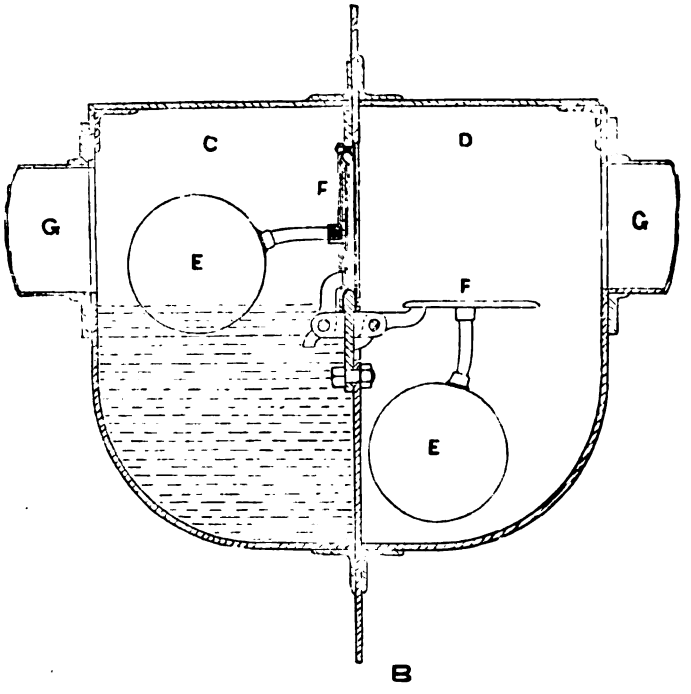


Fig. 4.

bulkheads at these points appears to have been entirely disregarded, probably because the openings were at a considerable height above the keel, and the danger not so manifest as in the case of "cross bunker" doors. It is, however, a mistaken idea to pass over any detail of ship construction without due attention, and as a matter of fact, water admitted into a compartment by collision or otherwise in the largest passenger vessels has not to rise many feet above the load-draft, before it will pass through the holes in the bulkheads arranged for ventilating purposes. Indeed, in some vessels this would be experienced before the water had run to the normal draft. It is therefore important that some means should be used to ensure the absolute security of a bulkhead at such points, more especially as ventilating shafts are usually of light construction, and might readily be damaged. We believe that Messrs. Watson & Sons' new patent automatic bulkhead air-valve meets the necessities of the case, where longitudinal ventilating pipes have to be fitted, owing to the impossibility of fitting direct and independent down and up-cast ventilators to every compartment. In Fig. 4 we illustrate this bulkhead air valve. Referring to the illustration C D is a small iron tank, fitted into the bulkhead, having a centre division, in which double indiarubber valve faces are fitted. Valves F F are hinged on either side, and copper floats E E at the ends of levers cause the valves to close, should water get into the tank C D through the ventilating pipes G; otherwise there is a free passage for the air. On the left-hand side of our illustration the aperture is shown closed, because of water in the compartment and on the right-hand side, *vice versâ*.

they are more widely known they will meet with increasing favour. Too much attention cannot be given to the efficiency of water-tight bulkheads, both in small and great matters. Wherever a small opening is made for the convenience of engineers or otherwise, care should always be exercised to make it absolutely watertight. Sometimes it is alleged that the engineering fraternity on board of steam vessels are reckless in this respect, but we can scarcely credit it. It may have been so in byegone years, but can scarcely be so now. Be this as it may, all parties concerned in the security of life and property at sea should seek in even the smallest detail to ensure the absolute watertightness of bulkheads.

Proposed Increase of the Russian Fleet. — The *Cronstadt Messenger* states that "there is much talk in naval circles of re-establishing the ancient naval divisions, each forming a separate squadron under an admiral, with a second admiral also attached to each squadron. According to this arrangement, the Baltic fleet would be composed of two squadrons, the Black Sea of one, and the Pacific of another. The number of ships' crews on service would also be increased. The Baltic fleet would have 19 instead of 8 as at present, and the Black Sea fleet 6 in the place of 2.

Fastest Voyage from the Cape of Good Hope.—The Union Steamship Company's Royal Mail steamer *Athenian*, which left Cape Town at 5.20 p.m. on Feb. 22, and Madeira at 6 p.m. on March 7, arrived at Plymouth at 2.25 p.m. on March 11. This passage is the fastest yet made between Cape Town and Plymouth, the total time being 17 days 21 hours 5 minutes, and the nett steaming time after deducting stoppages being 17 days 11 hours 10 minutes. This exceeds the passage of 17 days 23 hours 7 minutes gross, and 17 days 17 hours 7 minutes nett steaming time made by the same company's Royal Mail steamer *Tartar*, which, until now, had been the fastest on record.

THE GREENWICH FERRY.

ON Saturday, March 17th, there was launched from the yard of Messrs. Steward & Latham, Millwall, the *Countess of Zetland*, the second vessel built by the firm for the Greenwich Ferry Company. Although the weather was cold and a boisterous wind blew the half snow, half sleet that fell during the afternoon about in a most tantalising manner, yet a large number of visitors (including a goodly number of the fair sex) put in an appearance to witness the launch of this novel craft, and to wish her a successful career.

After partaking of the good things which the hospitality of the builders had provided (and which the inclemency of the weather rendered doubly welcome), an adjournment was made to the yard, and after an inspection of the hull, preparations were at once set about for getting her into the water.

Like her sister ship (the *Countess of Lathom*) the present vessel is built of steel, and will be provided with four screws, each 6 ft. diameter, two forward and two aft, which will be driven by two pairs of compound engines, having cylinders of 18 in. and 33 in. diameter, with a length of stroke of 24 in., steam being supplied from two return tube boilers, 11 ft. long by 10 ft. diameter, the boilers being placed forward and the engines aft to maintain an even keel. The dimensions of the vessel are 120 ft. in length over all, 40 ft. broad to outside of plates, and 11 ft. deep from top of beam to floors, the draught being 6 ft., and the displacement 466 tons. The deck of the vessel is of ¼ in. steel, and will be covered with 4 in. timbering and 4 in. wood block paving.

The vessel is very powerfully built, and is specially constructed so as to ride at the landing stages of each bank, her sides locking with the pier, and opening for carts and carriages. Four lines of rails, laid athwartships, will allow of eight railway trucks being taken across per voyage, while deck accommodation is provided for 14 or 15 ordinary carts.

The launch was in every respect a successful one, the christening ceremony being gracefully performed by Miss Cross, daughter of the managing director. Among the company present we noticed Admiral Sir E. A. Inglefield, C.B., Colonel Gordon, Colonel Bristowe, Captain Wardell, W. Evans, G. Nelson Arnold, Esq., the officers of the Ferry Company, and many others. The very successful manner in which the construction of this somewhat novel type of vessel has been carried out reflects the greatest credit on the builders, whose ability has been shown in the construction of these vessels to execute excellent work in a prompt and workmanlike manner.

LAUNCH OF THE "CITY OF NEW YORK."

ON March 15th there was launched from the Clyde shipbuilding yard of Messrs. James & George Thomson, the twin-screw passenger steamer *City of New York*, one of the two vessels built by this firm for the Inman and International Steamship Company and intended for the Atlantic trade. Great interest attached to the event, as the vessels are the largest built on the Clyde, and indeed the largest passenger steamers in the world, their tonnage being 10,500 tons. Additional interest was lent to the proceedings by the presence of Lady Randolph Churchill, who performed the ceremony of naming the vessel. The weather was boisterous, the wind blowing from the south-east with the velocity of a gale, while at frequent intervals snow fell in blinding showers. Special trains and steamers from Glasgow conveyed large parties to Clydebank, where Messrs. Thomson's yard is situated.

The launch was appointed to take place about one o'clock, but the tide did not serve for an hour and a half later, and the large crowd of spectators, numbering several thousands, meanwhile awaited the event with such patience as they could command. When at length the large vessel was released and began to glide down the ways, Lady Randolph Churchill in the customary manner named the ship the *City of New York*. The launch was perfectly successful, the vessel slipping into the river without perceptible list or quiver.

At the luncheon which followed, "Success to the ship and the Inman Company" was proposed by Mr. James R. Thomson, who presided, coupled with the name of Mr. Edmund Taylor, one of the directors of the Inman Company. In his reply Mr. Taylor said the Inman Company had striven with the aid of the builders to put afloat an entirely new type of vessel, their desire being to make travelling safe and comfortable for the public. They had in course of construction a sister ship, the *City of Paris*, which would be launched in August, and if these vessels proved to be a financial success others would follow. The Inman Company had not been in a great hurry in considering as to further ventures, because they might perhaps be able to improve on those now to be added to the fleet. Experience was a sound teacher, and unless they were foolish they would follow on the lines of the experience gained by the running of these two ships. The health of Lady Randolph Churchill was afterwards proposed and responded to.

The Inman Company, desirous of securing a vessel which would at least equal the *Umbria*, the *Etruria*, and the *America* in safety and popularity and also in speed, entered into negotiations with Mr. James R. Thomson, senior partner of Messrs. J. & G. Thomson, with the result that an order for two vessels, the *City of New York* and the *City of Paris*, was placed with the firm. The conditions laid down were that before all things the vessels should be as far as possible unsinkable, and that the internal arrangements should approximate more to the modern hotel than to the present steamship. With these two conditions fully provided, the speed was also to be the best attainable. The keel of the first boat was laid in June and that of the second a short time afterwards. The metal of which they are built is steel, which has been made at the works of the Steel Company of Scotland and at the Mossend Steel Company's works, and these companies have together applied about 20,000 separate pieces for each ship, weighing about 7,000 tons. It was thoroughly tested at the steelmakers' by Lloyd's surveyors, and has been carefully treated to prevent corrosion. Some idea of the strength of the vessel may be had when it is stated that it would take 60,000 tons to pull either asunder. That estimate is made from actual experiment with sectional parts. The vessels have been constructed throughout on the most approved principles of modern shipbuilding, and in many respects bold and beneficial innovations, based on scientific experiments, have been introduced. They are intended to be classed at Lloyd's, and have been very narrowly watched during their design and construction by the chief surveyor at Lloyd's, Mr. B. Martell, and his assistants, Messrs. Cornish and Edwards, while the local superintendence, with its many small details, has been left in the hands of Mr. Courtier Dutton. The rapidity with which the work has been executed may be imagined when it is stated that for some months during the construction something like 100 tons of steel were placed in position per day, and now the *City of New York* is launched, while the other steamer, the *City of Paris*, is in an advanced state. The former, as she stood in the yard, presented a fine appearance. Her great length of 560 ft., her beam 63 ft., and her height 44 ft., might well have attracted the attention of passengers on the river steamers. With the buildings on deck, she measures close upon 10,500 tons, making her the largest passenger steamer in the world. Stretching about 80 ft. from the ground stood her bow, with a clipper stem, gracefully decorated with the form of a female figure, carved with artistic taste by Mr. James Allan (Glasgow). This clipper stem, which gives beauty to the structure, has always been a feature of the Inman liners, and now that the company has been changed to the Inman and International, a conservative spirit has prevailed in this respect, and all who view the symmetry of the hull will commend this decision. Her stern is equally graceful in its lines. The overhang and neat rudder give the vessel the appearance of a yacht, because, owing to the propulsion being by twin screws and the peculiar formation of the rudder, there is no aperture or long projecting frame.

The steering power is a feature of the vessels, as, instead of being by the ordinary rudder, it is by Thomson & Biles's rudder, invented by Mr. James R. Thomson, senior partner, and Mr. J. H. Biles, the manager to the builders' firm. It is a huge mass, forming part of the ship, and partaking of its shape to the fine point of the rudder. It is pivoted on the bottom and inside the ship near the water line. The idea is to increase the rudder area and turning power of warships, in several of which it has been very successfully applied, giving increased rapidity of manœuvring power. Besides these advantages it enables the steering gear to be kept wholly below the water line. In this and other ways the vessels will be suited for armed cruisers. The steamers will be propelled by twin screws, and in this respect they are different from all previous Atlantic liners. The twin screws are supported by two massive steel stays, which are incorporated with a structure taking the place of the stern post. This structure of cast steel, made by the Steel Company of Scotland, is 26 tons in weight. Two sets of triple expansion engines are provided, and each is capable of propelling the steamers at about four-fifths their *maximum* speed.

The engines are of three crank triple expansion type, having piston valves throughout. They are of sufficient power to drive the ship at as high a speed as any vessel now running on the Atlantic. All the moving parts have, therefore, been made of the strongest yet lightest material, and care has been taken to provide ample bearing surfaces. Nearly the whole of the castings for the engines are of steel, and have been supplied by the Steel Company of Scotland, the largest casting weighing about 50 tons. Here it may be mentioned that during their construction the engines have been inspected by Mr. Parker, chief engineering surveyor of Lloyd's, and Mr. Doran, superintending engineer of the Inman International Company. In the ship the engines will be placed in two compartments, the division being effected by a watertight bulkhead running longitudinally and separating the port from the starboard engines, while transverse bulkheads on either side isolate them from other parts of the interior of the vessel. The boilers which supply the steam are in three separate compartments. The whole moving power of the ship is therefore divided between five compartments, so that if a collision did occur and the fracture in the ship's hull were at the bulkhead, resulting in two spaces being flooded, there would still be at least one set of engines and one set of boilers to allow the vessel to steam along at about four-fifths her *maximum* speed. With the exception of the air-pump, the auxiliary engines in the steamers—37 in all—will be worked independently of the main machinery. The engines for hoisting cargo in and out of the vessels are worked by hydraulic power, Messrs. Brown Brothers, Edinburgh, having supplied all in connection with these. There are nine cargo spaces, some of which have a couple of hoists for lifting the cargo from the hold and swinging it over the side noiselessly. For many other purposes lifts have been provided—raising the food from the galleys to the pantries, the stores from the store-room to the galleys, the engineers and firemen from the bottom of the ship, ashes from the boiler spaces to the main deck, from whence they are thrust overboard through tubes. Hydraulic power is also used to work the steering gear.

In each vessel there are two bottoms, and the interior of the ship is divided by transverse partitions into 15 separate watertight compartments. This principle of complete subdivision has been more fully developed in this than in any other passenger vessel. Attempts have been made in many first-class ships to minutely subdivide them, but this has always been rendered useless by doors being fitted at the bottom of the bulkheads to admit of passage from one compartment to another. These were supposed to be always shut, and in some cases were fitted with patent apparatus for closing them almost instantaneously; but even with these safety cannot be insured, and it has often occurred that at the critical moment either no one had presence of mind to close the door when the collision occurred or the way was blocked. In the case of the Inman steamers there are no doorways, and therefore there is no need of patent or other doors. Passage can only be obtained by going to the upper deck, which is above the water-line. The compartments are each 35 ft. long, and will hold to load-line 1,250 tons of water, so that even should two be filled the flotation of the vessel will not be seriously affected. Thus the vessels are provided against a collision. An equally serious evil to all ships is as effectually provided for. A few feet inside the outer bottom is an inner one, as strong and as watertight as the external one. The space between these is also available for carrying water ballast to the extent of 1,600 tons, with the view either of adding to the stability of the vessels or of altering their trim fore and aft.

The vessels, besides their double bottoms, have each five decks, the number of square feet in each being 27,000. The exposed or weather deck is called the promenade, and extends unbroken from end to end of the ships. On this deck is a long house with the best passenger rooms in the vessels, 25 in number. On the next, the upper deck, there is also a promenade on either side, about 10 ft. wide and extending for about four-fifths of the length of the vessels, and sheltered by the deck above. In the space in the centre between the two promenades is a house which contains the principal puplic rooms, saloons, dining, smoking, &c., and about 30 very fine state rooms. On the next two, the main and lower decks, there is accommodation for first and second class passengers, the former being principally located in the centre of the ship. Below these there is the orlop deck, which, with the space below, will be devoted to cargo carrying. In all over 2,000 people can be accommodated. As in the case of the National Liner *America*, the great feature of the internal arrangement of these steamers will be their saloons. On the main decks the roofs will be in the form of a great dome. This is a speciality of the builders, and is intended to give to the traveller the idea that he is in a hotel or mansion house instead of in a ship. Messrs. Thomson have taken the height of three decks and formed an arch, the top of which is parallel with the buildings on the top deck. The dome is supported by strong steel frames connected by a light yet firm structure covered with ornamented wood, the spaces being filled in with stained glass 1¼ in. thick. This arch does not occupy the whole of the saloon, and the alcoves are so formed as to be suitable for small dining parties. The ship is lighted by electricity, more than 1,000 incandescent lamps being provided. There are two engines, so that should one break down the other is available to prevent darkness. The whole apparatus has been supplied by Messrs. King, Brown & Co., Edinburgh.

The external appearance of the vessels will be smart. They have three masts, the foremost square-rigged and the other two fore and aft. Between the fore and main masts are three funnels, immediately in front of which is the bridge deck. These, with the clipper stem and the pole bowsprit, will make the vessels look well balanced. A prominent feature of the outward equipments of the vessels is the lifeboats ranged on either side, 22 boats in all having been supplied, and these will be capable of carrying all on board when the vessels are full.

MESSRS. JOHN BELL & SON'S ENGINEERS' STORES CATALOGUE.

WE have now before us a very complete priced and illustrated catalogue of the numerous articles supplied by Messrs. John Bell & Sons from their Engineers' Stores Department.

Though the firm are best and probably universally known from their asbestos specialities and products, yet the present catalogue includes such an assortment of engineers' stores as would only be found in a list issued by the oldest established firms.

As showing the scope of the book, we may mention that it consists of 200 pages and contains close upon 550 illustrations, while the prices and particulars given range from those of a belt fastener to a 30 H.P. boiler, drilling, planing and shaping machines, also lathes up to 10 in. centres likewise finding a place in the book. From a cursory examination of the book we should say that the prices would compare favourably with those of any other first-rate firm, while Messrs. Bell's name is sufficient guarantee that any article supplied by them would only be of the best as regards workmanship and materials.

PATENT EXHAUST STEAM INJECTOR COMPANY.—Owing to the removal of their works to Glasgow, Messrs. Sharp, Stewart & Co. have disposed of their injector business to the Patent Exhaust Steam Injector Company, who will take over the drawings, patterns, and templates of the various injectors hitherto manufactured by this company, as well as the whole of the standard live steam and exhaust injectors in stock.

CARDIFF.—The steam coal trade has shown considerable activity, the shipments made having exceeded even the high average hitherto attained this year. Some description of steam coal have advanced 3d. per ton, but other qualities have remained at former rates. The severe weather which has prevailed of late has imparted a firm tone to the house coal trade. A recent slight improvement in patent fuel has been fully maintained. The manufactured iron and steel trades have been scarcely so active; heavy sections of steel rails have made £4 to £4. 5s. per ton, and light sections £4. 15s. to £5. 5s. per ton.

THE IRISH EXHIBITION IN LONDON.

PERHAPS no exhibition of recent years is likely to give results more practically useful than the one which is to be opened early in the coming summer at Olympia, Kensington. Ireland possesses great natural resources and important industries, and a comprehensive display of what she can produce or manufacture will not only be an object lesson of greatest interest to the people of Great Britain, but will do much to assist the revival of trade in Ireland. The exhibition is begun under the happiest auspices. It knows neither politics, religion, nor class, but has for its executive council and patrons the most distinguished representative men. Perhaps for no other purpose could nearly 700 names, representing every phase of political, religious, and social life, be brought together in active union. The Executive Council are the Duke of Abercorn, the Duke of Westminster, K.G., Lord Charles Beresford, M.P., Sir R. N. Fowler, Bart., M.P., Mr. Herbert Gladstone, M.P., Mr. Ernest Hart, Lord Arthur Hill, M.P., the Earl of Lathom, P.C., Sir John Lubbock, Bart., M.P., Mr. Justin McCarthy, M.P., the Marquis of Ormonde, Mr. J. H. Raffety, Sir C. A. Russell, Q.C., M.P., and Lord Arthur Hill is the Honorary Secretary. The Trustees are Mr. Alfred de Rothschild, Mr. Ruthven Pym, Mr. Wilfrid A. Bevan, and Mr. H. F. Slattery. Prominent among the Patrons are the Archbishop of Canterbury, the Archbishop of Dublin, and Cardinal Manning, Archbishop of Westminster, the Marquis of Hartington, Mr. C. S. Parnell, M.P., the Lord Mayor, Sir John Whittaker Ellis, Bart., M.P., the Duke of Argyll, the Duke of Leinster, Lord Randolph Churchill, M.P., Rt. Hon. Peter O'Brien (Solicitor-General for Ireland), Sir William Ewart, Bart., M.P., Rt. Hon. Arthur Kavanagh, Mr. Labouchere, M.P., the Rt. Hon. Sir W. Hart Dyke, Bart., M.P., Sir James Spaight, Sir Patrick Keenan (President Committee National Education, Ireland), Sir John B. Greene, C.B. (Royal Agricultural Society, Ireland). With a view of giving the humble Irish artisan the same opportunity for exhibiting the product of his skill as the large manufacturer, the council have wisely determined to make no charge for the space occupied in the exhibition, except in special cases. The exhibition will be opened on the 4th of June, and remain open until the end of October, and the whole of the vast space at Olympia will be utilised. Among the special features will be a representation of an Irish Village, with the veritable peasants at work upon their cottage industries—the dyeing of yarn, making lace, knitting, &c.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from February 24th, 1888, to March 23rd, 1888:—

Abbott, William J., chief engineer to the *Buzzard*, to date March 1.
Adams, William H., engineer to the *Rattler*.
Babb, James F., staff engineer to the *Osborne*, to date April 1.
Baker, John G. L., engineer to the *Raleigh*, to date March 21.
Barclay, William, fleet engineer to the *Devastation*, to date March 22.
Barker, Robert J., staff engineer to the *Marathon*, to date March 5.
Bell, Lawrence, assistant engineer to the *Orion*, to date March 20.
Bissaker, George R., fleet engineer to the *Asia*, additional, to date March 10.
Butcher, John B., assistant engineer to the *Iris*, to date March 7.
Collins, A. E., assistant engineer to the *Curacoa*, to date March 15.
Cowley, Edwin J., fleet engineer to the *Raleigh*, to date March 21.
Cox, Albert E., assistant engineer to the *Raleigh*, to date March 21.
Crisp, Arthur S., assistant engineer to the *Polyphemus*, to date March 10.
Faulds, A. G. J., assistant engineer to the *Australia*, to date March 3.
Gaudin, Edward, assistant engineer to the *Raleigh*, to date March 21.
Haddock, S. G., assistant engineer to the *Curacoa*, to date March 15.
Harvey, W. A., staff engineer to the *Orion*, to date March 20.
Hughes, Thomas E. E., engineer to the *Plover*.
Hulford, Charles F., staff engineer to the *Pembroke*, additional for reserve, to date March 22.
Juniper, William V., assistant engineer to the *Orion*, to date March 20.
Larg, James C., chief engineer to the *Medea*, to date March 5.
Ludlow, George F. J., assistant engineer, to the *Hibernia*, additional, to date March 10.
Mitchell, George N. H., staff engineer to the *Victoria*, to date February 29.
Morris, F., chief engineer to the *Curacoa*, to date March 15.
Parsons, William G., chief engineer to the *Nymph*, to date March 15.
Pendrick, John R. J., engineer to the *Pigeon*.
Pettit, William J., staff engineer to the *Superb*, to date March 22.
Rees, John D., assistant engineer to the *Victoria*, to date Feb. 29.
Rule, Thomas, chief engineer to the *Sandfly*, to date March 2.
Ryan, James, assistant engineer to the *Brisk*, to date March 20.
Sharp, William, engineer to the *Conqueror*.
Spalding, Andrew, staff engineer to the *Mersey*, to date March 21.
Stephens, James, fleet engineer to the *Pembroke*, additional for reserve, to date March 22.
Stevenson, John E., staff engineer to the *Rupert*, to date March 3.
Stone, Alf T. H., assistant engineer to the *Brisk*, to date March 20.
Turner, Henry J., assistant engineer to the *Amphion*.
Williams, F. C., acting assistant engineer to the *Raleigh*, to date March 21.
Wright, John R. B., chief engineer to the *Brisk*, to date March 20.

INDUSTRIAL NOTES.

CLYDE AND EAST OF SCOTLAND.

THE chief contracts booked during the month in the Clyde district include a 4,000-ton steamer, secured by Messrs. Henderson, of Partick, one of over 3,000 tons for the petroleum bulk carrying trade secured by Messrs. Russell & Co., Port Glasgow, and a fast paddle-steamer for the Belgian Government, received by Messrs. Denny & Bros., Dumbarton. Messrs. Russell's is a repeat order of the steamships *Ocean* and *Chester*, lately built by them for Messrs. Hermann, Stursberg & Co., of New York. The dimensions of the new vessel will be—length, 310 ft.; breadth, 39 ft.; and depth, 25 ft. The last two vessels built by Russell & Co. for this trade gave great satisfaction during their trial trips. The paddle-steamer to be built by Messrs. Denny is for the mail and passenger service between Dover and Ostend, and is a duplicate of the *Princess Henriette*, recently launched by the Messrs. Denny and expected to attain a speed not hitherto approached by any channel steamer. The vessel secured by Messrs. D. & W. Henderson, Partick, is for Messrs. Bell, Bros., and McLelland, Glasgow, and is a steel screw steamer of 4,000 tons deadweight, for the general cargo trade.

The Ailsa Shipbuilding Company, Troon, have booked a contract for a steel screw steamer of 500 tons deadweight carrying capacity. Her dimensions are—length, 150 ft.; breadth 25 ft.; and depth, 12 ft., and she will be fitted with triple expansion engines of about 500 H.P. She is for Capt. Weatherill, of the firm of Messrs. McKenzie & Co., Dublin, and will be engaged in their cargo trade between the Clyde, Mersey, and Dublin. The Ailsa Shipbuilding Company have at present three other vessels building. Messrs. J. & G. Thomson, Clyde Bank, have secured the contract to supply two screw steamers belonging to the Union Steamship Company with triple expansion engines. The Union Company have already had six of their older steamers' engines converted into the triple expansion type.

In view of the increased traffic which the International Exhibition will cause, the North British Steam-Boat Company are getting a steamer built for their Helensburgh route by Messrs. T. Seath & Co., Rutherglen. She will be 200 ft. in length by 21 ft. beam, with fore and aft saloons, and will be fitted by Messrs. Hutson & Corbett with diagonal compound engines. The Loch Lomond Steamboat Company have also resolved to build a new steamer for the Loch Lomond steamboat service, but the contract is not fixed as yet. She will be a very handsome vessel, the largest yet on the lake, and will be fitted with all the latest improvements both as respects structure and engines.

Shipbuilders and marine engineers are still complaining of bad delivery of material from the manufacturers, and in connection with this we may mention that several small orders have been given for German shipbuilding steel by Clyde shipbuilders to merchants in Glasgow. The steel is to be made by Herr Krupp, at the famous Essen Works, and will be subjected to the pre-

scribed tests by Lloyd's surveyors before leaving the works. It is unnecessary to say that the reputation of Herr Krupp as a maker of steel is among the highest in Europe, but whether the German steel will compete in any great quantity, or for any length of time, with the home manufacture is probably not to be expected.

In the Port Glasgow and Greenock district all the yards are well employed. Messrs. Russell & Co. have at present twelve vessels under construction in their three yards, but two of these vessels will be launched shortly. Messrs. Murdoch & Murray have sold to foreign buyers the screw steamer *Chazely*, the construction of which they have just completed. She is about 450 tons gross, and has been fitted with compound surface condensing engines by a local firm. The fitters' labourers in several of the yards were out on strike for some time, but work is now resumed, the demand of the workmen for extra wages having been conceded.

At Dumbarton, Messrs. Denny & Bros. are briskly engaged on the two important Spanish steamships referred to in previous month's notes.

Messrs. A. McMillan & Son, of the same town, have recently secured a contract for a steamer of 1,200 tons from foreign owners. They launched at the beginning of the month the first of two composite screw steamers building by them for the Government mail and passenger traffic round the coasts of Newfoundland.

Messrs. W. B. Thomson & Co., Limited, Dundee, have received an order from a local firm engaged in the coal trade to build a large steamer. Orders to build two petroleum carrying steamers will, it is expected, be also booked by Dundee builders at an early date. The trade in carrying petroleum in bulk has lately assumed great importance; as the advantage of doing away with the expense of barrels and the labour attendant upon making and stowing them is of great importance to the consumer, by cheapening the cost of import. It is evident that the *Great Eastern*, now lying at the Tail of the Bank, is not intended for further service, as tenders are being asked for taking out her paddle engines, paddle boxes, shaftings, sponsons, and paddle wheels. The cable tanks are presently being broken up, about twenty to thirty men being employed on the work, and the compartments in which the large telegraph cables were stowed will soon be things of the past.

The Glasgow Exhibition Buildings have been practically complete for some time, and exhibition goods are now being received and placed. An enormous staff of workmen and exhibitors' representatives are daily engaged erecting and putting exhibits in order against the opening day, which is fixed for the 8th May. The Prince and Princess of Wales have consented to open the Exhibition, and every one concerned is strenuously endeavouring to ensure that the opening day will really see a *complete* exhibition, and not, as in so many instances, a partial and hastily improvised semblance of completeness. The ground inside the Exhibition boundaries is 66 acres. The actual space covered in amounts to 14 acres, including buildings, such as outside dining-rooms and the Bishop's Palace. The covered-in space is then equal to that of the Manchester Exhibition of last year, while the enclosed grounds are in excess of those at Manchester by at least 20 acres. The machinery section occupies 150,000 square ft. of floor area, this again being 15,000 ft. more than at Manchester. Equally with the rest of the Exhibition buildings, the machinery section is ready for the reception and placing of exhibits. In it is an overhead travelling crane, having a lifting capacity of 20 tons, its suitability for the large amount of work it will have to discharge having already been tested. The 15th of April is the last day on which exhibits will be received. In next issue a full and detailed description of the buildings and its contents, so far as then evident, will be given.

ANOTHER DOCK FOR CARDIFF.—A syndicate of capitalists is credited with an intention to apply to Parliament for powers to construct a dock and canal on the foreshore on the east of the mouth of the Rumney. The proposed canal, if carried out, will be nearly two miles in length, and will be of sufficient width to allow vessels to load and discharge on either side of it. A jetty will in all probability be constructed on the east side of the mouth of the river; from this jetty excursion steamers will be able to leave at all states of the tide. It is stated that to enable the largest sea-going vessels to enter the proposed dock only about 300 yards of dredging will be required, the water in this part of the channel being much deeper than at the entrance of the Bute Docks. The cost of carrying out the proposed scheme is roughly estimated at £1,000,000.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—The most important incident that has occurred in connection with the Tyne shipbuilding trade in March, is the re-opening of Messrs. Palmer's Howdon Yard, after a period of four years' stoppage. The keel blocks for a vessel of the largest class have been put down, and three other berths are being prepared for the reception of keels. The firm have six large vessels on the stocks at their Jarrow Yard, and it is understood that the only two berths now remaining vacant will shortly be occupied. The plating of one of the large vessels on the stocks, at the Tyne Shipbuilding Co.'s yard has been commenced and the work of other vessels that are in earlier stages is being actively pushed on. Messrs. Schlesinger & Davis recently launched the *Tynesider*, a vessel ordered by the Tyne Steam Navigation Company, with the special view of shortening the sea passage between Newcastle and London. She is a superior vessel in every way, and can scarcely fail to satisfactorily fulfil the expectations entertained regarding her. The firm have just laid the keels for two other vessels, and their establishment shows unmistakable indications of participating in the activity likely to prevail in the majority of Tyne shipyards during the present year. They have still on the stocks, however, a vessel built during the last busy period, and it may be stated that this is the only vessel constructed on the Tyne at that time which still remains unsold. Messrs. Swan & Hunter will shortly launch one of the four vessels on their stocks, the other three being still in comparatively early stages. A few months ago, the two yards belonging to the firm were absolutely bare of work, but they are now among the busiest concerns on the river. Messrs. Hawthorn & Leslie are busily proceeding with the construction of four vessels for the celebrated "Gulf" Company of Greenock, and as they have other important orders in hand, the whole of their departments must necessarily be kept busy for a lengthened period. The alterations and extensions which have been for some time in progress at Messrs. Armstrong & Mitchell's, Low Walker Yard, are now completed, and the vacant building berths are being occupied with keels. The firm have made oil carrying steamers a speciality, and it is understood that they have half a dozen vessels of that class now to proceed with. Among the new machines lately put down by the firm is a set of powerful plate straightening rolls by Messrs. Craig & Donald. These rolls are capable of dealing with the very heaviest class of work, and constitute an indispensable accessory in shipbuilding establishments where the construction of very large vessels is undertaken. The firm to which reference is now being made have provided a similar set of rolls by the same makers for their Elswick Yard; but, unfortunately, at the last-mentioned establishment, they are not at present being greatly utilised, as there is but little work in hand. The fittings of the armour-plated ship *Victoria* are now so nearly completed that it is intended to remove her to Chatham on an early day in April. Messrs. Wood & Skinner have one good-sized vessel in the framing stage, but their other berths are empty, and Messrs. Dobson & Co. have five vessels on the stocks, one of which is being prepared for launching. Messrs. Readhead have their yard quite full of work, and Messrs. Edwards have three out of their six berths occupied. The Tyne Engineering and Dry Docks Company are carrying out extensive repairs to the s.s. *Paolo*, and the Wallsend Slipway Company have been pretty busy with repair work lately. The other repairing establishments on the river continue to be fairly well employed. In Marine Engineering business continues brisk. Messrs. R. Stephenson & Co. have four sets of triple expansions in hand, all of them being of large power. Two of these sets are for vessels that are being built at their Hebburn yard, and two are ordered for boats in course of construction at other establishments. The unfavourable weather lately experienced has retarded building operations at their new boiler works, Hebburn, and it has consequently been found impossible to commence the construction of boilers at so early a date as was anticipated. The s.s. *Tynesider* is being engined at the North-Eastern Engineering Works, Wallsend, where, as in all the other large engineering establishments, an unusually heavy pressure of work exists. Messrs. Donkin & Nichol, of the St. Andrew's Engine Works, Newcastle, have just now a large number of orders for their patent combined hand and steam-steering gears, which are deservedly attaining a very high reputation. These articles are ordered for vessels building in the principal yards of the Tyne, Wear, and Clyde, and the [illegible] have also several orders for the same speciality from foreign

The firm have beside a number of orders for their com-

bined engines and fans, to be used in the production of forced draught in marine boilers. The orders now in hand are all being executed for the fitting up of steamers of a superior class. Messrs. Carrick & Wardale are well supplied with orders for their bilge and ballast pumps, and their establishment is kept in steady operation. The forging establishments on the Tyne are in almost every instance kept busily working, and in connection with the iron and brass founding trades there is no complaint of slackness. The manufacture of steel has been successfully commenced at Messrs. Hawks, Crawshay & Son's Works, Gateshead, and an important opening for the employment of labour has thus been created. The Newburn Steel Works are, as usual, quite active; the excellent quality of the work turned out continuing to enhance the high character of the establishment. Messrs. Sproat & Marley's Steel Works, Hebburn, are also busy, and the Redheugh Iron and Steel Sheet Works may be similarly described. The Wire Rope Works of Messrs. T. & W. Smith, St. Lawrence, are kept busily employed on orders for steamers' rigging, and at Messrs. Haggie Brothers' Rope Works, Gateshead, there are plenty of orders on hand in connection with the fitting out of ships and for colliery purposes. Messrs. George Angus & Co., Leather and Indiarubber Manufacturers, are just now very busy on orders connected with engineering purposes, and which have chiefly been obtained from local firms.

The Wear.—During the month of March a good many launches have taken place on the Wear, and it is a promising feature with the local shipbuilding trade that in all cases the vacated berths have been filled by keels for other vessels. The orders for the latter, however, were obtained as far back as December last, when a sudden spurt in the demand for tonnage resulted in many shipbuilders getting their order books well filled. The excitement caused by the pretty general rise in freights, which then took place, has now, however, almost entirely subsided, and inquiries for new tonnage are almost as rare as they were six months ago. Indeed, some shipbuilders complain that they are worse off now than then, for although orders have been obtained, the prices of material have gone up, while no commensurate advance has taken place in the prices of new vessels. However this may be, it is certain that, so far as the leading yards on the Wear are concerned, there has been work enough secured to keep them busy over the present year, and from the point of view of the general public this circumstance cannot but be regarded as satisfactory. It was noted in last month's report that Messrs. R. Thompson & Sons had disposed of a large steamer to Japan, and to this information it is a satisfaction to be able to add that Messrs. Doxford's steamer, the *Trans-Pacific*, which it may be stated in passing is the largest vessel ever built on the Wear, has now been sold to the British India Steam Navigation Company, for employment in the passenger and cargo trade. Extensive alterations, which will afford employment to a large number of men for months to come, have been commenced on the vessel to fit her for the requirements of the Company. Messrs. Short Brothers and Mr. James Laing have each a steamer of exceptionally large dimensions to build, besides a number of others of smaller size. Messrs. R. Thompson & Sons are busily plating a large vessel, and are about to lay down another of somewhat similar dimensions. They are also repairing in their graving dock the locally owned steamer, *Howard*. Messrs. J. L. Thompson & Sons have launched four vessels since the opening of the year, and the whole of their berths are now occupied. Though the weather for some weeks past has been exceedingly unfavourable for shipyard work, the orders in hand at this establishment are being pushed forward with wonderful rapidity, a circumstance which no doubt is mainly due to exceptional resources and able management. In reference to the other establishments, there is nothing of special interest to state excepting that there is now, perhaps, less stoppage through the non-delivery of material than was the case a month ago. At the Marine Engineering establishments briskness continues to be the unvarying feature. Messrs. Clark & Co., Southwick, have just completed the engining of the s.s. *Pallas*, a splendid vessel built by Messrs. Rayton, Dixon & Co., of Middlesbrough, and they have now on hand two locally constructed vessels. The four-cylinder engine fitted in the s.s. *James Drake*, by Mr. John Dickinson, has proved a great success, a circumstance which is peculiarly gratifying, as it is the first of the kind ever turned out on the Wear. The Bloomfield Engine Works, Monkwearmouth, continue to be kept steadily going, the orders in hand being mainly for piston rod packing, patent piston rings, &c.; and at the Pier Engine Works, South Docks, business is also fairly active. Messrs. C. & M. Douglas have become the district agents for a new slide valve, respecting which particulars will be given in a future report. Messrs. John Lynn & Co., and Messrs. Welford Bros., both keep very busy on orders for steam winches, &c. The establishment known as King's Forge Pallion, which has been idle for a couple of years, has just been put in operation. The work in hand consists of stern frames, &c., for Messrs. Doxford, shipbuilders, and it is understood that they have been the chief movers in re-opening the place. The prospectus of a new Company, formed to purchase from the present proprietors the Monkwearmouth Ironworks, has been issued. From this it may be seen that the intention is to further develop the iron manufacture, and to put down plant for the commencement of the steel manufacture.

The Hartlepools.—At this centre the shipbuilding industry is still in a most satisfactory condition, and at each of the establishments engaged in the trade a full complement of hands is kept on. The engineering establishments continue to be full of work, and forges are as busy as could be wished. The shipping trade of the port is just now very quiet.

The Tees.—The leading shipbuilding establishments at Stockton and Middlesbro' continue to present an appearance of activity; and with reference to marine engine works, boiler works, and bridge works, the same may be said. Steel works are exceedingly busy, one of the most important firms having recently booked an order of great magnitude. In the finished iron trade a healthy tone is still apparent.

LAUNCHES AND TRIAL TRIPS.

Launches—English.

Beethoven.—On February 27th, at the shipbuilding yard of Messrs. Joseph L. Thompson & Sons, North Sands, Sunderland, a steel steamer was launched of about 3,500 tons deadweight capacity, built to the order of Mr. Jenneson Taylor, of Sunderland. The vessel is built on the cellular bottom and web-frame principle for the highest classification, having longitudinal plate intercostal stringers, thereby dispensing with the hold or orlop deck beams, the cargo holds being sub-divided by six steel divisional bulkheads, to which each fore and half stringer is thoroughly connected. The engines, which are of the triple-expansion type, have been built by Mr. John Dickinson, of the Palmer's Hill Engine Works. They are of the most improved design, having patent valve gear and Dickinson's patent steel-built crank shaft. The boilers are of steel and of the multitubular form, having a working pressure of 160 lbs. to the square inch. The vessel was named the *Beethoven* by Mrs. Jenneson Taylor.

Ben Clune.—On February 28th there was launched from the shipbuilding yard of Messrs. James Laing & Son, Deptford, Sunderland, a steel steamer, built to the order of Messrs. John Morrison & Son, North Shields. The dimensions of the vessel are:—Length, 275 ft.; breadth, 38 ft.; depth, 20 ft. 6 in. The carrying capacity is about 3,000 tons on a light draught. The vessel is of the raised quarter-deck type, with bridge extending to the foremast. She is bracket framed in the lower holds, and will have two masts, schooner-rigged. The vessel is to be engined with engines of 180 H.P. by Mr. George Clark, of Southwick Engine Works. She is fitted with patent horizontal direct steam windlass by Emerson, Walker & Co. On leaving the ways the vessel was named the *Ben Clune* by Mrs. Bolton, wife of one of the shareholders of the vessel.

Evelyn.—On February 29th Messrs. W. Gray & Co. launched a fine steel screw-steamer of the following dimensions:—300 ft. over all, 38 ft. beam, and 22 ft. 2 in. depth, of 3,500 tons deadweight capacity, built to the order of Messrs. T. Appleby & Co., West Hartlepool, and classed 100 A1 at Lloyd's. The vessel is of the well-decked type, with poop aft containing saloon and cabins for officers and a few passengers, long raised quarter-deck, long bridge of extra strength right up to fore-hatch, and containing comfortable quarters for the crew. The usual top-gallant forecastle is fitted forward with Emerson, Walker & Co.'s windlass. The hull is built on the web-frame principle, dispensing with hold beams, and giving a clear hold for working cargo; five hatches are fitted, four steam winches, steam steering gear, and two donkey boilers; double bottom under each hold for water ballast. The boats are carried on beams overhead. The vessel will in every respect be well equipped for general trading. The engines, which are on the three-cylinder triple-expansion principle, are being supplied by Messrs. Blair & Co., Ltd., Stockton-on-Tees. The vessel has been superintended during construction by Captain

Baker, on behalf of the owners, and is the eighth vessel owned by Messrs. Appleby & Co. which has been built by W. Gray & Co. She was gracefully christened *Evelyn* by Miss Rathbone, Greenbank, Liverpool.

Mei Shih.—On February 29th there was launched from the shipping yard of Messrs. R. & W. Hawthorn Leslie & Co. (Limited), Newcastle-on-Tyne, the second of two steel twin screw steamers, built by them for the Royal Mail and Passenger Service of the Chinese Government. The dimensions of the vessels are:—Length, 260 ft.; breadth, 34 ft.; depth, 19 ft. The vessel is built to the highest class at Lloyd's, with deck-house for the accommodation of passengers from the after end of forecastle to the stern. Over this house is an awning-deck extending the full width of the ship, and of the same length as the house. Forward of engine and boiler space, in the large deck-house before mentioned, is a handsome saloon for first-class European passengers, together with the necessary state rooms, lavatory arrangements, &c. This saloon will be handsomely fitted in carved oak framing and Hungarian ash panels, and at the fore end will be furnished with a handsome piano in oak case to match the framing. On each side of the engine and boiler hatches are the officers' and engineer's cabins. Abaft the engine-room, also in this house, is the accommodation for first-class Chinese passengers. This saloon will be handsomely decorated, with state rooms at the sides; a large cabin aft being fitted to be used as a ladies' cabin, or for the use of the governor of the province. On the awning-deck forward is the chart-house, wheel, captain's cabin, &c., together with the entrance-house to the European quarters. At the after end of the awning-deck is a large music saloon, forming the entrance companion to the Chinese quarters. This saloon will be handsomely fitted and supplied with an organ for the use of the Chinese. In the 'tweendecks forward is accommodation for the Chinese second-class passengers, and in the 'tweendeck abaft the engine-room for the third-class Chinese, the whole of this accommodation being well lighted and ventilated in the most approved manner. The vessel throughout will be lighted by the electric light (including mast head) side lights, cargo lamps, &c., which is being supplied by the Woodside Electric Light Co., of Glasgow. The vessel has steam windlass and steam winches by Messrs. Clarke, Chapman, Parsons & Co., and also steam steering gear. The vessel will be driven by two sets of triple-expansion engines, having all the latest improvements, including Marshall's valve-gear, &c. There will be two multitubular double-ended boilers, which will be fitted with forced draught and worked at a pressure of 160 lbs. A high rate of speed is anticipated. These vessels are being built under the supervision of Messrs. A. & W. Dudgeon and Mr. Cromarty, who are acting on behalf of the Chinese Government. The vessel was christened the *Mei Shih* by Mrs. Ridley. A large number of friends were present, including Mr. Dudgeon, Mr. Cromarty, Sir B. C. Brown (chairman of the company), Mr. Coote, Mr. Marshall, Mr. Ridley, Mr. Trewent, &c.

Pallas.—On February 29th there was launched from the yard of Messrs. S. P. Austin & Son, Wear Dockyard, Sunderland, a steel sailing barque of the following dimensions:—Length between perpendiculars, 233 ft.; breadth, 37 ft.; depth of hold, 21 ft. 9 in.; nett register tonnage about 1,406 tons. The vessel is constructed with a half poop, large iron house on deck for crew, topgallant-forecastle, iron lower masts, bowsprit, and lower and topsail yards. She is fitted with patent lever windlass by Emerson, Walker & Co. She will be classed 100 A 1 at Lloyd's under special survey, and it is also proposed to class the vessel in the Bureau Veritas Register. The vessel will be registered in Germany, and she will be commanded by Captain Mehring. The vessel was named *Pallas* by Mrs. Stanley Austin.

Charters Tower.—On February 29th there was launched from the shipbuilding yard of Messrs. John Readhead & Co., West Docks, South Shields, as crew steamer, built of steel, of the following dimensions—viz., 317 ft. by 40 ft. by 27 ft., classed at Lloyd's 100 A 1, special survey, and will have a total deadweight capacity of about 4,600 tons. She will be fitted with triple-expansion engines of 300 H.P. nominal, the engines and boilers being also made by Messrs. J. Readhead & Co. The machinery combines all the most recent improvements for economising fuel consumption, being supplied with feed-water heaters, evaporators, &c., and with the hull has been built under the superintendence of Messrs. Ashlin & Co., the owners' superintending engineers, Captain M'Nabb being the resident superintendent for the construction of the hull. The vessel has been built to the order of Messrs. F. Stumore & Co., of London, and is named the *Charters Tower*, being the second of that name built for the same firm, the previous one having been sold to Italian owners. The christening ceremony was performed by Mrs. Gemmell, of North Shields.

Knight Companion.—On February 29th at Palmer's Shipbuilding Yard, Jarrow, a cargo steamer was launched. Dimensions:—Length, 415 ft.; breadth, 45 ft.; and depth, 30 ft. 6 in. She is built of steel, to take the highest class at Lloyd's under the three-deck rule, being built considerably in excess of their requirements. She will carry 6,200 tons deadweight on a moderate draught. A powerful steam-steering engine is placed at the after end of bridge, with shafting led to steering house on bridge, and screw-gear aft. There will be fitted five powerful steam winches for quick despatch in loading and unloading, and specially designed horizontal direct acting working two capstans on forecastle, by Emerson, Walker & Co. The engines are also by the Palmer Company, having three cylinders—29 in., 47 in., and 76 in. diameter, and a stroke of 51 in.; I.H.P., 3,000. Steam will be supplied by two extra large double-ended boilers, constructed of steel for a working pressure of 150 lbs. per square inch, and the expected speed will be 11 knots. The vessel has been built to the order of Messrs. Greenshields, Cowie & Co., of Liverpool. As she left the ways she was named *Knight Companion* by Miss Thomas.

Fulford.—On March 1st there was launched from the yard of the builders (Messrs. Raylton, Dixon & Co.) the steel screw-steamer *Fulford*, built to the order of Messrs. J. M. Lennan and Sons, of Middlesbro'. She is of the following dimensions:—Length, 267 ft., breadth, 36 ft., and depth, 19 ft. 6 in.; and she will carry a deadweight of over 2,500 tons. She is built on well-deck principle, with long bridge-deck extending to foremast, and is in many respects a great improvement upon the last vessel built for the same firm, for whom Messrs. Raylton, Dixon & Co. have already built six steamers. She will be fitted with triple-expansion engines, on the latest improved principle, by Messrs. Blair & Co. (Limited), Stockton, and has a powerful direct acting windlass, Emerson, Walker & Co.'s patent. The launch was witnessed by a large number of her local owners, and the vessel was christened the *Fulford* by Mrs. John Milner Lennard.

General Roberts.—On March 1st Messrs. Cook, Roberts & Gemmell launched from their shipbuilding yard, at Hull, an iron steam trawler, built to the order of Messrs. Pickering & Haldane. The vessel's dimensions are:—Length, 100 ft.; breadth, 20 ft. 6 in.; depth, 11 ft. She will be fitted with compound surface condensing engines by Messrs. C. D. Holmes & Co., as well as with all the latest improvements for the North Sea fishing business. She was named the *General Roberts* by Master Frank G. Gemmell.

Challenger.—On March 1st Mr. Edward Wales launched from his yard, at Hull, an iron screw tug, built to the order of Mr. Hugh Ward, of Grimsby. Length, 59 ft. 6 in.; beam 14 ft.; depth, 8 ft.; steel boiler, 100 lbs. pressure; engines, compound furnace condensing, 112 I.H.P. As the vessel left the ways she was named the *Challenger* by Miss Nora Ward, the daughter of the owner.

Crathorne.—On March 2nd Messrs. W. Gray & Co. launched, at West Hartlepool, a steel screw steamer of the following dimensions: Length over all, 310 ft. by 40 ft. 6 inches breadth, by 23 ft. 0½ in. deep; to carry 3,950 tons. Built to the order of Messrs. R. Ropner & Co., West Hartlepool, and classed 100 A 1 at Lloyd's. The vessel is of the well-decked type with poop aft, containing saloon and cabins for officers, engineers and a few passengers; long raised quarter-deck, long bridge of extra strength right up to fore hatch, topgallant forecastle with accommodation for crew and petty officers, and having Messrs. Emerson, Walker & Co.'s windlass on top to work Parkes' patent stockless anchors stowing into hawse pipes, without the use of the usual crane and cat and fish tackling. The hull is built on the web frame principle, dispensing with hold beams, and giving a clear hold for working cargo. Five hatches are fitted, four steam winches, steam steering gear, and two donkey boilers, water ballast under each hold. Two iron masts will be fitted, and a full equipment for general trading purposes. The engines, which are on the triple expansion principle, are being supplied by Messrs. Blair & Co. (Limited), Stockton-on-Tees. During construction the vessel has been superintended by Captain C. D. Rooke. The christening ceremony was performed by Mrs. Matthew Gray, Grove House, Greatham, the vessel being named *Crathorne*.

John Adye.—On March 6th a flush-decked sailing barge, named the *John Adye*, was launched by Mr. H. Reynolds, at Lowestoft, of the following dimensions:—Length over all, 86 ft.; beam, 20 ft.; depth, 6 ft. 8 in. This vessel is built to the order

of the War Department for carrying ordnance, and will be stationed at Priddy's Hard, Portsmouth.

Virgo.—On March 8th, Messrs. Earle's Shipbuilding and Engineering Company (Limited), launched from their yard at Hull an iron steam trawler, named the *Virgo*, which they have built for the Grimsby and North Sea Steam Trawling Company (Limited). This boat is 107 ft. 3 in. long by 20 ft. beam by 10 ft. 9 in. depth of hold, and is of somewhat similar design and arrangement to the *Zodiac*, the plans of which took prizes at the Shipwrights' Exhibition in London in 1882, and at the International Fisheries Exhibition, 1883, but in many respects it is a decided improvement on that ship as well as on the *Virgo* and *Libra*, recently constructed by Earle's Company for the same owners, the former of which she has been built to replace. The christening ceremony was performed by Mrs. Anthony Bannister, jun.

Hampton.—On March 9th there was launched from the yard of Messrs. John Blumer & Co., North Dock, Sunderland, a screw steamer of the following dimensions:—Length, 280 ft.; breadth, 38 ft.; depth, moulded, 21 ft. 6 in. She is built to the order of the Commercial Steamship Company, London, and on leaving the ways she was christened *Hampton* by Miss Buckle, of York.

Nith.—On March 10th Messrs. Edwd. Withey & Co. launched from Middleton Shipyard, Hartlepool, a steel screw steamer built to the order of George Steel, Esq., of West Hartlepool, for Messrs. Steel, Young & Co., of London. This is the 152nd vessel on the builders' books, and the 26th they have built for the same owner. The vessel is a fine type of a modern cargo boat, and is built of Siemens-Martin steel. She is over 300 ft. in length, with a large measurement and dead-weight carrying capacity. The ship has a long, raised quarter-deck, short poop, and long bridge house, with a top-gallant forecastle. The main bridge, quarter and forecastle decks, skylights, bulwark rails, bulkheads, cargo battens, etc., are built of iron or steel. In the main and after holds she is built on the web frame system, dispensing with hold beams, thus enabling the steamer to carry cargoes of the most bulky description, such as machinery, torpedo boats, large guns, &c. She has a cellular bottom all fore and aft (Withey & Sivewright's patent), and the after peak will also be available for water ballast. The vessel is also fitted with four steam winches, two donkey boilers and patent direct steam windlass, Emerson, Walker & Co.'s patent, on forecastle, hand and steam steering gear amidships, and patent screw stand-by gear aft. The accommodation for officers and passengers is under the poop aft, and is fitted up in hardwood with beautifully hand-painted panels by the lady decorative staff of the firm. The steamer is rigged as a two-masted fore and aft schooner, with iron masts, and is built to the 100 A1 class at Lloyd's, under the personal superintendence of George Steel, Esq. She will be fitted with triple-expansion engines by Messrs. T. Richardson & Sons, Hartlepool. On leaving the ways the vessel was gracefully christened *Nith* by Miss Henrietta Janet Steel.

Remus.—On March 10th there was launched complete, with steam up ready for sea, from the shipbuilding and engineering works of Messrs. Oswald, Mordaunt & Co., at Southampton, the first of two screw steam fishing vessels built to the order of F. W. Leybourne Popham, Esq., of Littlecote, Hungerford, Wiltshire. The dimensions are as follows:—Length, 134 ft.: breadth, 20 ft. 6 in.; depth, 10 ft. 9 in. The vessel has a long raised quarter deck extending to forward engine-room bulkhead, turtle back forecastle fitted with steam windlass, crane, and breakwater. Accommodation for owner, captain, officer, and engineer is provided under quarter-deck aft, the crew being berthed in a sunk forecastle. The vessel is ketch-rigged and classed at Lloyd's 100 A 1. After the launch the vessel steamed away on her trial trip. The engines, by the same firm, are of triple expansion type; cylinders 12½ in., 19 in. and 31½ in. in diameter, with a stroke of 24 in. Joy's patent valve gear is fitted to each cylinder, and she has a large steel boiler constructed for a working pressure of 158 lbs. per square inch. On trial the engines worked smoothly and without trouble, propelling the vessel at a high rate of speed. The vessel on leaving the ways was christened the *Remus* by Miss Popham.

Tynesider.—On March 13th there was launched from the shipbuilding yard of Messrs. Schlesinger, Davis & Co., a beautifully modelled steel screw steamer named *Tynesider*, built to the order of the Tyne Steam Shipping Company. The vessel has been designed for the special purpose of reducing the length of sea passage between the Tyne and London, the machinery being of very exceptional power. The dimensions of the vessel are as follows:—Length over all, 269 ft. 6 in; length between perpendiculars, 260 ft.; breadth, moulded, 33 ft. 6 in.; depth, moulded, 18 ft.; depth of hold, 17 ft. The steamer has been constructed to take the highest class at Lloyd's, and will be fully equipped for a Board of Trade passenger certificate. Sleeping accommodation will be provided for about 76 first-class passengers amidships. The saloon, extending the full breadth of the ship, will be at the fore end of the long, full poop (which extends from about two-thirds the vessel's length), and will be handsomely panelled in Hungarian ash, teak, and other fancy woods. The state-rooms, which are abaft of the saloon, will be comfortably finished and upholstered. A large teak deck-house on the poop-deck contains wheel house, captain's, and chart house, handsomely furnished, entrance house and smoke room, the latter being equipped with handsome marble tables and all requirements for smokers. Sleeping accommodation for about 120 second-class passengers will be provided under the long topgallant forecastle. In addition to these a large number of deck passengers will be carried, so that the total number of passengers will be not less than 300. The comfort of the passengers has been carefully studied in every possible manner, both by the owners and builders, and it is the object of the former to render the passage as pleasurable as possible; and it is estimated the addition of this vessel to their fleet will considerably augment the number of passengers travelling by sea to and from the Metropolis. Although cargoes are usually carried both ways by the Tyne Steam Shipping Company's steamers, the *Tynesider* is amply provided with water ballast in a double bottom constructed on the cellular principle, so that even in event of leaving port with very little cargo on board she will still be in very comfortable trim. As these vessels usually have very little time in port to discharge and load their cargo, special attention has been paid to this important department. Four very powerful cranes (two at each hatch), as well as a powerful winch, are to be placed on board by Messrs. Clarke, Chapman, Parsons & Co., who will also supply a direct acting steam windlass. The *Tynesider* will be lighted throughout by electricity, the installation being completed by Mr. Rankin Kennedy, of Glasgow. The side lamps and masthead lamps will also be illuminated by electricity, and two 500 candle power lamps will be provided for the cargo hatches, so that the vessel may be loaded or unloaded without delay during the dark hours. It is expected that the *Tynesider* will be in advance of any other of the Company's boats, in point not only of comfort and completeness of arrangement, but also in the very important point of speed. With this view engines of unusual power, in comparison to her size, will be placed on board. These engines, which are placed aft, are being built by the North Eastern Marine Engineering Company (Limited), at their Wallsend works, and designed to indicate 2,250 H.P. The engines are on the triple-expansion three-crank type, having cylinders 28½ in., 46 in., and 75 in., with a stroke of 42 in. The design is that adopted by this firm for triple-expansion engines, the chief feature of which is the great accessibility of working parts, and the very small amount of space occupied. Indeed, we believe that machinery of this power has never before been put in so small a space. All the latest improvements in marine engines have been adopted in these engines, and all working parts are made with the greatest care, and with large surfaces in view of the high rate of piston speed. Steam is supplied at 160 lbs. pressure from three large single-ended boilers, arranged in the ship (two forward and one aft), so that all the firing is done in one stokehole. Each boiler has four Fox's patent corrugated furnaces—the two centre and each of the wing furnaces leading into separate combustion chambers, and the smoke boxes joining a single funnel in the centre of the stokehole. The construction of the ship and machinery has been supervised by Mr. David Moffat, of Newcastle, the Company's head engineer. Upon the vessel leaving the ways she was christened by the Mayoress of Newcastle (Mrs. W. D. Stephens) in the presence of a large and distinguished company.

Seafarer.—On March 14th Messrs. W. H. Potter & Sons launched from their shipyard, Queen's Dock, Liverpool, a sailing vessel of the following dimensions:—Length, 280 ft.; beam, 41 ft.; depth in hold, 24 ft. 6 in.; tonnage, nett register about 2,200 tons, deadweight capacity about 3,500 tons, exclusive of stores. As the vessel left the ways, she was named the *Seafarer* by Mrs. James H. Potter. The *Seafarer* has been built on lines similar to the ship *Wayfarer*, launched from the same works about 18 months ago. She is classed 100 A at Lloyd's, but is considerably in excess of these rules; her frames are spaced close together, her beams, floors, deck plating, and other portions of scantling being much heavier than Lloyd's requirements, in addition to which the whole of the butts of the outside plating are treble

riveted for over half of the vessel's length amidships. She is constructed of Siemens-Martin steel, manufactured by the Steel Company of Scotland, the Consett Company, and Messrs. Dormon, Long & Co. The *Seafarer* is fitted with all the most recent improvements, including Messrs. Harfield's patent steam winch, geared capstan windlass, extra deep chambered pumps, steel wire rigging and rigging screws, two iron houses on deck, and will be rigged as a four-masted ship. She is chartered out to Calcutta with a cargo of salt, and will be commanded by Captain Jackson, late of the ship *Conbermere*.

Rio Tinto.—On March 15th Messrs. Short Brothers launched from their shipbuilding yard at Sunderland a steel screw steamer, built to the order of Mr. John Tully, of that port. The vessel, which is built of Siemens-Martin steel, is classed 100 A1, under special survey, in Lloyd's Registry, and is constructed with cellular bottom throughout, divided for trimming purposes. There is a full poop aft for accommodation of officers, the bridge-house amidships has accommodation for engineers in the after end, and the top gallant forecastle has accommodation for the crew, all being connected by means of a gangway fore and aft. The holds are fitted up with ore trunks for the trade in which the vessel will be principally engaged, all the latest appliances being fitted for rapid despatch in loading and discharging cargo, there being four steam winches on the compound principle, and having a multitubular donkey boiler working at a pressure of 150 lb. The vessel was named *Rio Tinto* by Miss Elizabeth Tully, daughter of the owner. The vessel is to be fitted with engines of 180 H.P. on the triple-expansion three crank principle, with two steel boilers of large size, working at 150 lb. pressure, by Mr. John Dickinson, Monkwearmouth.

Loch Lomond.—On March 16th, at the Jarrow yard of Palmer's Shipbuilding and Iron Company, Limited, a screw steamer of the following dimensions and particulars was launched:—Length, 312 ft. between perpendiculars; breadth, moulded, 40 ft.; depth, moulded, 27 ft. 5½ inches. She is built of steel to take the highest class in Lloyd's, on the three deck rule, and will load 4,050 tons deadweight on a moderate draught. She has two steel decks laid; accommodation for captain and ten passengers in full poop; engineers and officers are berthed in the long bridge amidships, and the crew in topgallant forecastle; double bottom for water ballast on the cellular system throughout after holds; and engine and boiler, and in fore-and-aft peaks she has five watertight bulkheads. She will be provided with a direct steam capstan windlass steam steering gear amidships, screw gear aft. The engines will also be manufactured by the Palmer Company, having cylinders 23 in., 37 in., and 60 in., and a stroke of 42 in., pressure 165 lbs. There will be two large single-ended boilers, two donkey boilers, and five steam winches. The vessel, which has been built to the order of the Dundee Loch Line Company, Limited, of Dundee, was christened the *Loch Lomond*, by Miss Rodger, daughter of Mr. Rodger, one of the directors of the Loch Line Company.

Birchfield.—On March 17th Messrs. Joseph L. Thompson and Sons launched from their shipbuilding yard at North Sands a steel steamer of about 3,500 tons deadweight capacity, built to the order of Captain Joseph Brown, of Liverpool. This vessel is of the raised quarterdeck type, and on the improved system of web frame construction adopted by Messrs. Thompson, having six steel bulkheads, dividing the vessel into seven watertight compartments. The engines are of 220 H.P., of the triple expansion type, and have been built by Mr. John Dickinson, of Palmer's Hill Engine Works. Two steel boilers, each of 150 lbs. pressure, will be fitted. The deck machinery consists of direct steam windlass, steam winches, and steam-steering gear, supplied with steam from donkey boiler, which is placed on deck. The vessel, on leaving the stocks, was named the *Birchfield*, by Miss Thompson, of Ashville. The *Birchfield* will be commanded by Captain Hugh Ferguson, of Liverpool; and the engines have been, during construction, under the supervision of Mr. Reid on behalf of the owner.

Phyllis.—On March 17th a new iron ship of 1,500 tons burthen, built at the Albion Dockyard by Messrs. Charles Hill and Sons, was launched. The length of the vessel is 197 ft., her breadth 32 ft. 8 in., and depth 19 ft. 10 in. Her gross register is about 974 tons and nett 936. She has a raised quarter-deck, is provided with Chapman's patent windlass, and Trotman's patent anchors. Her lower masts, lower and lower-topsail yards, and bowsprit are of iron, and the rigging is of charcoal wire. She has an East Indian outfit, and is classed *100 A1 at Lloyd's. When rigged she will sail for Australia. The name selected was *Phyllis*, after a daughter of the eldest member of the firm, and was bestowed on the vessel by Mrs. Burrow Hill.

Sunbeam.—Messrs. J. F. Waddington & Co. recently launched from their shipbuilding and engineering works at Seacombe, near Liverpool, a handsomely modelled screw tug, fitted with engines of 50 H.P. for towing purposes, &c., at Belfast. She is fitted with a neat saloon forward for carrying passengers, and has a guaranteed speed of 10 knots.

LAUNCHES.—Scotch.

Hailoong.—On February 29th Messrs. Ramage & Ferguson, Leith, launched from their yard a steel screw-steamer, built to the order of Mr. John J. Lapraik, London, and intended for the Douglas Steam Shipping Company, Hong Kong. The vessel, which is 230 ft. in length, 33 ft. in breadth, and 21 ft. in depth (moulded), has triple expansion engines of the most modern design, and suitable for a high rate of speed. Being intended for carrying a large number of passengers, as well as cargo, this steamer has her 'tween decks fitted up fore and aft to accommodate natives, while Europeans are placed in a teak house on the upper deck aft. All latest appliances for facilitating the working of the ship and cargo have been introduced. The vessel was named the *Hailoong* by Miss Henderson, and after the launch was towed round to the Albert Dock to receive her masts and machinery. The *Hailoong* will be commanded by Captain Pocock, late of the *Thales*, belonging to the same company.

Chaseley.—On February 29th there was launched from the building yard of Messrs. Murdoch and Murray, Port Glasgow, a steel screw steamer of the following dimensions, viz.:—169 ft. by 23 ft. by 11 ft. 6 in., the gross tonnage being 430 tons. The vessel has been built to the highest class at Lloyd's under special survey, has water ballast in double bottom, horizontal steam winches, and all modern improvements. The machinery consists of a pair of compound surface-condensing engines, the cylinders being 20 in. and 40 in., with a 30 in. stroke. Tubular steel boilers have been supplied, the working pressure being 90 lbs., proved to Board of Trade requirements for passenger service. The machinery will be supplied by Messrs. Dunsmuir & Jackson, engineers, Govan. The vessel was named the *Chaseley* by Miss Marion Murray, daughter of one of the builders.

Olymp.—On March 2nd Messrs. Charles Connel & Co. launched from their shipbuilding yard at Scotstoun a sailing ship, built of steel, for foreign owners. The ship, which is named *Olymp*, is 247 ft. long, 38½ ft. broad, and 22 ft. 8 in. deep, her tonnage being 1,600. She is intended for the general trade, and is fitted with all modern appliances for rapidly loading and discharging cargo.

Conscript.—On March 10th Messrs. A. M'Millan & Sons, of the dockyard, Dumbarton, launched the first of two composite screw steamers building for the Government mail and passenger traffic round the coasts of Newfoundland. The vessel is of the following dimensions:—Length, 190 ft.; breadth, 30 ft.; depth, 22½ ft.; and gross tonnage, 750 tons. She has been built to contend with the ice which will be so much met with in the course of her passages. The construction forward is of very great strength, and the stem and bows are shod with heavy iron plates to protect the wood planking when entering the heavy ice. The vessel is having powerful machinery of the triple-expansion type made by Messrs. David Rowan & Sons, of Glasgow, and will be of 800 indicated H.P. The vessel will be fitted for 68 first-class and 90 intermediate passengers, the whole accommodation being on the 'tween decks. The vessel was named the *Conscript* by Miss Ethel Colls, of London, and will be worked by Messrs. Harvey & Co., of St. John's, Newfoundland, who have the contracts with the Government.

Algonquin.—On March 14th Messrs. Napier, Shanks, & Bell launched from their yard at Yoker the steel screw steamer *Algonquin*, a vessel of about 1,800 tons, specially designed for the Canadian lake service, to class 100 A1 at Lloyd's, having large carrying capacity, and with accommodation for a number of passengers. She is also specially fitted for rapid loading and discharging of cargo, and a good rate of speed will be attained from powerful triple expansion engines of the most improved and economical type supplied by Messrs. Dunsmuir and Jackson. The vessel was named by Miss Shanks, of Pollokshields.

Saikio Maru.—On March 14th the London and Glasgow Shipbuilding Company launched from their yard, at Govan, a steel screw steamer, built to class 100 A1 at Lloyd's, spar decked rule. The vessel has been constructed for the mail and passenger service to the order of the Nippon Yusen Kaisha of Japan, under the personal superintendence of Captain A. R. Brown, managing director of the Royal Mail Steamship Company of Japan. The dimensions of the vessel are 325 ft. by 40 ft. 6 in. by 21 ft. 6 in., moulded to main deck. There is accommodation for 52 first-class passengers on the main deck and in house under shade deck, together with officers and engineers, and 24 second class passengers, while in the forecastle there is space provided for 140 emigrants, crew, and firemen. The carrying power of the vessel is 2,240 tons deadweight, or 20 ft. main draught. The steam capstan is Baxter & Co.'s patent, as also the gipsy capstan aft. The steam winches, steam gearing, and hand-steering gear are by Messrs. Muir & Caldwell. The ship is to be entirely lit by electricity. The builders of the vessel are also putting in the engines. They are of the triple expansion inverted, direct acting type, and very powerful, steam being supplied by two double and two single-ended boilers, with a working pressure of 160 lb. per square inch. In the designing of the engines all the latest improvements have been adopted, and the ship is expected to attain a very high rate of speed. As the vessel slid into the Clyde it was named *Saikio Maru* by Miss Bain, daughter of Sir James Bain.

Princess Henriette.—On March 14th Messrs. Wm Denny & Bros. launched from their building yard at Dumbarton a paddle-wheel steamship of about 1,250 tons gross measurement. She will be supplied with powerful compound engines by Messrs. Denny & Co. This steamer is built to the order of the Belgian Government for the postal and passenger service between Ostend and Dover. The ship was named *Princess Henriette* by Mrs. Dunn, wife of Mr. R. H. Dunn, Belgian Consul in Glasgow.

Princess Louise.—On March 14th Messrs. D. & W. Henderson & Co. launched from their Shipbuilding yard at Meadowside, Partick, a steel screw steamer, built to the order of Messrs. M. Langlands & Sons, for their North of Scotland trade. Her dimensions are—225 ft. long, 32 ft. beam, and 21 ft. 4 in. deep, the gross tonnage being about 900 tons, and she is built to Lloyd's highest class. The engines are to be of the triple expansion type, the cylinders being 17 in., 28 in. and 46 in. diameter, and 33 in. length of stroke. The ceremony of naming the vessel *Princess Louise* was performed by Miss Wingate.

Mediterranean Passenger Steamers.—On March 24th Messrs. Wm. Simons & Co., Renfrew, launched two handsomely-modelled screw steamers for passenger service on the Mediterranean. Steel is used exclusively in the hulls. They are flush decked and have fore and aft saloon accommodation for passengers. The engines are compound surface condensing, of 85 H.P., and the boilers are constructed of steel for a working pressure of 120 lbs. per square inch.

Virginia.—On March 24th Messrs. Russell & Co. launched at Port-Glasgow a finely-modelled steel screw-steamer, named *Virginia*, of the following dimensions:—Length, 296 ft.; breadth, 38 ft.; depth, 20 ft. 6in. This steamer is about 1,600 net register, and has a dead weight carrying capactity of 3,600 tons. She is designed for the grain trade, and is to the order of Mr. Frederick Woods, London. Her construction has been superintended by Mr. Davin Pollock, consulting naval architect and engineer, Glasgow. Immediately after launch she was towed to Glasgow to be supplied by Messrs. James Howden & Co. with her machinery, which is of the triple expansion type. On the ways vacated by this launch, Messrs. Russell & Co. lay down the keel of what will be the largest sailing ship in the world, her net register tonnage being a little over 3,300 tons.

LAUNCH—Irish.

Bostonian.—On March 14th there was launched from the shipbuilding works of Messrs. Harland & Wolff, Belfast, a new steamer named the *Bostonian* for Messrs. Frederick Leland & Co., of Liverpool. Her dimensions are:—Length, 420 ft.; breadth, 42 ft.; and depth, 34 ft. 6 in. She is fitted with triple expansion engines, and will trade between Liverpool and Boston, carrying passengers and cattle.

LAUNCH—German.

Valeria.—On February 15th the Flensburg Shipbuilding Company launched from their yard a fine passenger and cargo steamer built for the Hamburg Pacific Line. This steamer will be classed in 1st Division of Bureau Veritas. She is built of steel and has double cellular bottom. The cabin for 30 first-class passengers is fitted amidships on the spardeck and has all newest improvements for the hot climate. Her dimensions are:—length, 296 ft. 3 in.; breadth, 36 ft.; depth 25 ft. 7 in. Her engines 1,350 I.H.P., also built by the Flensburg Shipbuilding Company, are on the triple expansion principle. As the steamer left the ways she was christened *Valeria* by Mrs. E. Bredsdorf, the wife of the managing director of the Flensburg Shipbuilding Company.

TRIAL TRIPS.

Elsa.—On February 23rd the new steel cargo-steamer *Elsa*, built for Mr. H. Schuldt, of Flensburg, by the Flensburg Shipbuilding Company, made her first trial trip, which was a great success. The new triple expansion engine worked in a very satisfactory way, and the vessel attained a speed of 10·3 knots. The dimensions of this steamer are:—200 ft. 3 in. by 30 ft. 6 in. by 14 ft. 3 in. The Flensburg Shipbuilding Company has lately booked a lot of orders, and has now ten large steamers in progress all with triple expansion and all to be built of German steel.

Amber.—On February 23rd the new telegraph cable steamer *Amber*, the fifth vessel for a similar purpose which has been built and engined by Messrs. R. Napier & Sons, Govan, for the Eastern Telegraph Company, proceeded down the Firth on her official trial. The *Amber* is the smallest vessel of the fleet which has been built by Messrs. Napier for the company; but internally her space has been well utilised. The dimensions of the steamer are as follows:—Length, 210 ft.; breadth, 31 ft.; depth, 24 ft.; tonnage (builders' measurement), 978 tons. The hull is of steel. Besides the usual fittings of a first-class vessel, all the most modern improvements have been introduced to make the steamer efficient for her special work. Cable gear and electric lighting will be fitted on board in London, and the testing room will be there supplied with the most improved instruments. The steamer is propelled by triple-expansion engines, the cylinders of which 19.30.46 by 36. Steel is supplied from two steam boilers having a working pressure of 160 lbs. On several trials over the measured mile a mean speed of about 13¼ knots an hour was obtained—a remarkably good result considering the length of the vessel and her unequal trim, caused by the absence of her telegraph machinery, &c.

Oonah.—On February 25th this vessel, built for the Tasmania Steam Navigation Company by Messrs. A. and J. Inglis, Pointhouse, completed her official trial by making a run from Cloch Lighthouse round Ailsa Craig and back, at a mean speed of 14·255 knots, having on board 1,050 tons of dead weight. The *Oonah* is the largest vessel yet built for the trade between Hobart and Sydney, and is about four times the tonnage of the *Derwent*, the first vessel built at Pointhouse for the same owners twenty-four years ago.

Flying Cormorant.—On February 27th the Clyde Shipping Company's new steam-tug *Flying Cormorant*, built by Messrs. Robert Duncan & Co., Port Glasgow, and engined by Messrs. Rankin & Blackmore, Greenock, left the East India Harbour and proceeded down the river on her trial trip. The *Flying Cormorant*, which has been built to replace the *Gulliver*, lost some time ago off The Smalls, has been fitted with every improvement for the efficient carrying out of the work connected with the tugboat service. The accommodation for the officers and crew almost resembles that to be found on board a first-class passenger steamer. By this addition, the number of tug steamers belonging to the Clyde Shipping Company is 26.

Galealva.—On February 29th the new screw steamer *Galealva* went to sea for a loaded trial trip. This vessel has been built by Messrs. Wood, Skinner & Co., Bill Quay, to the order of Mr. H. Wilson, Cardiff. She is a fine specimen of cargo vessel, the dimensions being:—Length, 260 ft.; breadth, 36 ft.; and draught, 17·10. She is on the raised quarter-deck principle, and has water ballast throughout. The engines of 800 H.P., are made by the North-Eastern Marine Engineering Company, Wallsend, with clyinders 20, 33, 54 and 36 in. stroke, with a working pressure of 160 lbs. During the trial the engines worked without any hitch whatever, and gave every satisfaction, a mean speed of 12½ knots being attained in a rough sea.

San Fernando.—On February 29th the *San Fernando*, a light draught stern wheel cargo and passenger steamer, built for

Messrs. Japp & Kirby, of Liverpool, specially designed and constructed by Messrs. James Taylor & Co., of Birkenhead, with all the latest improvements for inland navigation in South America, was tried under steam, the machinery working most satisfactorily. The engines are high-pressure, with early cut-off, and the boiler, of the locomotive type, is of very large proportions, arranged to burn wood, is entirely of steel, the working pressure 160 lbs. per square inch, and tested by water to 320 lbs. The load of draught water, with 10 tons deadweight on board, is only 18 in., the speed 12 miles an hour, revolution of the paddle-wheel 62 per minute. The vessel is built in segments for shipment; length about 100 ft.; breadth, 13 ft. 6 in.; depth of hold, 4 ft.; material, steel galvanised. The *San Fernando* leaves for her destination next week; and has been constructed very quickly, the plans only being approved on 20th December last. This boat is only one of many that the above firm has designed, and built both for speed and light draught, this branch of their business being under the direct supervision of Mr. J. H. M. Taylor, N.A.

Retriever.—On March 1st the twin-screw steamer *Retriever*, recently built by Messrs. W. B. Thompson & Co., Limited, Dundee, went down the river to test the work of her machinery. A start was made from Camperdown Jetty in the forenoon, and in an hour the light-ship was astern. After proceeding a few miles further east the vessel was put about for the calmer waters of the Tay. After luncheon the vessel was again put to sea. Dundee was reached at 5 o'clock. The engines wrought with remarkable smoothness, and the vessel gave evidence of being a credit to her builders and owners.

Immortalité.—On March 3rd the new steel armourplated cruiser *Immortalité*, 12 guns, 5,000 tons, 8,500 H.P., left Sheerness for a full-power trial of her engines and boilers under forced draught. The trial was of four hours' duration, and was of a successful character in every respect, there being a total absence of hot bearings or of priming of the boilers. Working at 115·5 revolutions per minute, the engines developed 8,737 H.P., with a mean speed for the four hours' run of 19½ knots. On the natural draught trial, on March 2nd, of the new cruiser, which has been engined by Earle's Shipbuilding Company, the engines developed 6,090 H.P., and propelled the ship at a speed of eighteen knots per hour. The machinery worked well, and there was a total absence of priming and of hot bearings.

Hoopoe.—On March 5th the official trial trip of the steamship *Hoopoe* took place, one of the Cork Steamship Company's vessels, which has just been fitted with triple expansion engines, &c. The contract for the new machinery was given to Messrs. David Rollo & Sons, Fulton Engine Works, and the performance was beyond the expectation of those interested. The engines are on the three-cylinder, three-crank, surface-condensing, direct-acting principle, having cylinders 21 by 33 by 53 in. diameter respectively, the stroke being 36 in. There are two single-ended steel boilers, carrying 160 lbs. pressure per square in. The dimensions of the vessel are as follows:—236 ft. 6 in. long; 31 ft. 6 in. beam; 16 ft. 8 in. depth of hold; and 1,297 tons gross register. On the measured mile the mean speed attained was 12¼ knots, with the engines running 70 revolutions per minute. The new machinery has all been made to the specification of and under the personal supervision of Mr. F. C. Kelson, the company's engineer, while Captain Croft has superintended the alteration and improvements of the hull.

Fearless.—On March 5th this topedo cruiser, which is to relieve the *Falcon* on the Mediterranean Station, completed her three hours' preparatory trial, under natural draught, at Portsmouth. He trim gave a mean immersion of 14 ft. 6½ in., and as this shows that she is only half an inch deeper in the water than was estimated for, she is considerably more fortunate than several other vessels of late. She has yet to receive her shell and ammunition, but the extra weight of these will make no appreciable difference in her displacement. As the power to be developed on the trial was strictly limited by the Admiralty, no attempt was made to force the engines. The mean pressure of steam in the boilers was 112 lbs., and with 131 and 132 revolutions by the starboard and port engines, 2,169 horses were indicated. The average speed realised was 15·281 knots, or only about half a knot short of the speed obtained when tested with nearly a couple of feet less draught.

Trelawny.—On March 5th the *Trelawny* (s), built by Messrs. John Readhead & Co., West Docks, South Shields, for Messrs. Edward Hain & Son, St. Ives, Cornwall, was taken to sea on her trial trip. The *Trelawny* is of the improved well-decked type, built of steel and having the following dimensions, viz., 259 ft. by 36 ft. by 19 ft.; classed 100 A1 at Lloyd's, special survey; and is fitted out with all the appliances required in the Black Sea and Mediterranean grain trades. She is fitted with triple-expansion engines of 170 H.P. nominal, supplied with steam from two large steel boilers, working at a pressure of 160 lbs. per square inch. The machinery and boilers are also the manufacture of Messrs. J. Readhead & Co. On the trial trip, although there was a heavy sea running, the steamer attained a speed of 10½ knots per hour on the measured mile, running 80 revolutions per minute, and in every respect the vessel and machinery behaved admirably, and gave great satisfaction to all concerned. The vessel proceeded to Tyne Dock to load, and will sail under the command of Captain Wallis.

Endeavour.—On March 6th the *Endeavour* (s), which has been built by Messrs. R. Stephenson & Co., of Hebburn and Newcastle, for Messrs. M'Intyre Brothers, of Newcastle, had her trial trip. The vessel is 290 ft. long and 40 ft. in beam. Her engines have been built by Messrs. Blair & Co. (Limited), Stockton. They are on the triple-expansion principle, of 200 H.P.N., with cylinders 23½, 37 and 61 in. in diameter respectively, by 42 in. stroke, and working at 170 lbs. pressure of steam. The trial was of a satisfactory character. The vessel attained a speed of 10 knots an hour on a consumption of about 13 tons of coal per day, carrying over 3,500 tons of cargo, and drawing nearly 22 ft. of water. After the trial the vessel proceeded on her voyage to Bombay.

Palestro.—On March 8th the *Palestro* (s), built and engined by Messrs. R. W. Hawthorn, Leslie & Co. (Limited), of Newcastle, for Messrs. Schiaffino and Solari, of Genoa, proceeded to sea to undergo her official trial trip. The *Palestro* is built of steel to Lloyd's 100 A1 class special survey, and of the following dimensions:—Length 340 ft., breadth 42 ft., depth 28½ ft., with engines on the triple-expansion principle, cylinders 27, 43, and 70 by 45 in. stroke, two large double-ended steel boilers, working pressure 150 lbs. She is fitted with powerful steam winches, patent steam windlass, stockless anchors, steam steering gear, and all modern improvements for quick and economical working, in addition to all extra requirements of the Italian regulations for carrying emigrants. This is a boat of 5,200 tons deadweight, and will make a valuable addition to the fleet of Messrs. Schiaffino and Solari. She is also the largest deadweight carrier yet owned by the Italian mercantile marine. The average speed obtained by several runs on the measured mile was 11¼ knots.

India.—On March 10th the steamer *India*, built by Messrs. T. Royden & Sons, for the India Steam Shipping Co., of Liverpool, had a successful trial trip. The vessel is built of steel by Messrs. Thomas Royden & Sons, of this port, and is schooner-rigged, being classed 100 A1, with extra strength above Lloyd's requirements. Her length is 360 ft., breadth 44 ft., and depth 28 ft. 6 in., gross tonnage 3,582, net 2,333, carrying capacity 5,700 tons with Lloyd's free-board. She is fitted with double bottom and deep ballast tank forward of boilers, having a total capacity of 1,100 tons water ballast. She is also fitted with five steam winches, steam windlass (Emerson & Walker's patent), and Harrison's steam steering gear. The engines are by Messrs. Fawcett, Preston & Co., of Liverpool, and are of the triple-expansion, surface-condensing type, having cylinders 27 in., 44 in., and 71 in. diameter respectively, with a stroke of 4 ft. The propeller blades are of cast steel, secured to a cast iron boss by steel bolts; in fact, steel has been extensively used throughout the whole of the work. There are two double-ended steel boilers, each having six furnaces, fitted with Galley's patent fire bars, giving steam at a pressure of 150 lbs. per square inch. Mr. Gilbert S. Goodwin, who is superintending engineer of the vessel, and of a sister vessel now being built and engined by the firms, attended the trial. Messrs. Thos. Royden & Sons were represented by Mr. T. B. Royden, M.P., and Mr. Joseph Royden, jun., and Messrs. Fawcett, Preston & Co. by Mr. H. Shield and Mr. J. G. Archbold. Invitations to attend the trial were accepted by several superintending engineers, among whom were Mr. Wilkie, of the Spanish line of steamers of Messrs. Bahr, Behrend, & Ross, Mr. Derber, of the City of Dublin Steampacket Company, and Mr. Tarbrett. Professor Hele Shaw, of the Engineering Department University College, Liverpool, was also present, with a detachment—15 in number—of the engineering pupils of the College, who appreciated very much the opportunity afforded them of seeing so interesting a trial. Mr. MacVicar and Mr. Marshall (Messrs. MacVicar, Marshall & Co.), managers of the India Steamship Company, were also present. The engines were run at varying speeds, from slow to as high as 75 revolutions a minute, without the slightest hitch. The trial trip was in every way most successful. The boat and her engines and boilers were the subject of general admiration,

and it may safely be asserted that no finer example of modern marine work of the highest class has ever been turned out of any port in the kingdom.

Tropic.—On March 17th the steamer *Tropic* went down the Clyde on her trial trip at loaded draught. This vessel has been built by the Whitehaven Shipbuilding Company, to the order of E. C. Tbin, Esq., of Liverpool, and was sent round to the Clyde to have her machinery fitted on board by Messrs. Dunsmuir and Jackson, Govan. The hull and machinery have been under the superintendence of Mr. T. F. Irwin, Liverpool. She is built of steel to class 100 A1 at Lloyd's, special survey. Her length is 200 ft.; breadth, 37 ft.; depth of hold, 71 ft. Her machinery consists of triple-expansion engines, 20 in. by 33 in. by 54 in., having a stroke of 36 in. Steam is supplied by two large boilers at a working pressure of 160 lbs. All the newest improvements are fitted to ensure quick despatch in loading and discharging. After proceeding down the river she was tried at the Skelmorlie measured mile, when, with 2,600 tons d.w. on board, on a mean draught of 17 ft. 9½ in., she at ained a mean speed of 10¾ knots per hour. The engines indicated 990 H.P.

Correspondence.

[It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—ED. M. E.]

FEED-HEATERS.

To the Editor of THE MARINE ENGINEER.

SIR,—In your valuable paper (THE MARINE ENGINEER) I have with pleasure read the articles on feed-heaters. All engineers agree that the feed-water should be discharged into the boiler as hot as possible, but they do not agree as to where about in the boiler it should be discharged. Some say at the water level, others at the height of the furnace crowns, and a third, at the bottom. Some of your able readers, who may know of some of the experiments made to ascertain the best plan to discharge the feed-water to produce the best circulation, may kindly inform

ENQUIRER.

CHINESE SOAPSTONE.

To the Editor of THE MARINE ENGINEER.

SIR,—Referring to a letter on Chinese soapstone, signed by Mr. F. C. Goodall, surveyor of shipping to the Trinity House, which appears in your issue of to-day, we beg to inform you, Mr. Goodall and your readers, that we have been for some time occupied with the same material, and that we have embodied it in a protective paint for the inside of steel and iron ships, bridges, woodwork, &c., which we are about to bring before the public under the name of "Holzapfel's Patent Soapstone Composition." We may as well inform you that we have some time ago secured patent rights for this invention, and that, if any other person embodies soapstone in a paint, he would commit an infringement of our patent rights.

We are glad to fully bear out the statements in Mr. Goodall's letter, for we are quite confident that soapstone as a pigment for paint is superior to any other material, and that before many years its adoption will *completely revolutionise* the paint trade of this country. We shall be glad to send samples and prices (the latter being so cheap as to make the competition of other paints a thing out of the question) to any of your readers.

We are, dear sir, your obedient servants,

M. HOLZAPFEL & CO.

Newcastle-on-Tyne, *March 1st*, 1888.

SWEDISH IRONCLAD "GATA."—The new Swedish ironclad *Gata* will be armed with two 25-centimetre guns, four 15-centimetre guns, two 38-millimetre machine guns, four 25-millimetre four-barrelled machine guns, and two two-barrelled machine guns with an appliance for shooting self-propelling mines, and carry ix 38-centimetre self-propelling mines.

Miscellaneous.

NEW HARBOUR AT YOKOHAMA.—Arrangements are being made by the wealthy merchants of Tokio and Yokohama to build a harbour, wharf, and graving dock at the last named place. The different promoters have not yet arrived at a complete agreement as to the whole of the above works, but a graving dock will certainly be built, and is estimated to cost 1,000,000 yen.

THE BUTE DOCKS.—The question of the amalgamation of the Bute Docks with the Taff Vale Railway was further considered by the Taff Vale directors last month. The Board, observing that all sections of the proprietors had recognised the importance of securing an identity of interest with the Bute Docks, but that doubts had been expressed by certain shareholders upon questions of detail, unanimously decided not to proceed for the present with the proposed amalgamation.

EFFICIENCY OF STEAMSHIPS.—A lecture on this subject was given on Monday night, March 12th, by Mr. Henry Dyer, M.A.' under the auspices of the Clyde Steam and Sailing Ship Association. In the course of a discussion which followed, some severe remarks were passed on the policy observed by Lloyd's Committee, the principal speakers being Mr. Robert Duncan, shipbroker, Port-Glasgow, and Mr. A. C. Kirk, of Messrs. Robert Napier & Sons.

EXHIBITION OF LIFE SAVING APPARATUS.—An exhibition of a very interesting character will be held next month at the Peoples' Palace, London. It will consist of unsinkable war ships, steam vessels, lifeboats and rafts, for use at sea and on shore; also life saving apparatus of every description, and clothing. Conferences will be held from day to day, and discussions on the merits of exhibits. Application for space, or to read papers, must be made in writing only to the Chairman, Life Saving Apparatus Committee, the Peoples' Palace, Mile End Road, London, and are coming in freely.

BARCELONIA EXHIBITION.—At the request of the Secretary of State for Foreign Affairs, the Society of Arts has undertaken to promote the interest of the Exhibition in this country, and to act as the intermediary between British exhibitors and the executive of the Exhibition. The Exhibition is announced to be open on the 9th April, and the date for the receipt of applications from foreign exhibitors has already passed. A request for an extension of time has been made to the Spanish executive. In the mean time, British manufacturers who wish to take part in the Exhibition, and have not already sent in applications for space, may apply to the secretary of the Society of Arts, John Street, Adelphi, W.C.

THE NEWCASTLE STEAM BOILER INSURANCE COMPANY.—The ninth annual meeting of the Newcastle on-Tyne Steam Boiler Insurance Company, Limited, was held on March 5th, at the offices of the company, 34, Grey Street. The chairman of the company (Alderman Thomas Gray) presided, and there was a large attendance of shareholders. The annual report of the directors, recommending the usual dividend, the balance-sheet, and the engineer's report, were presented. The Chairman, in moving the adoption of the reports, referred to the satisfactory state of the company and the slight nature of the accidents that had occurred to the boilers they had insured. Referring to the bill brought before Parliament by Lord Stanley, of Preston, for the compulsory registration and inspection of boilers, he said that one of his co-directors had been in consultation with some of the other boiler insurance companies as to the operation of the bill in the event of it becoming an Act of Parliament, seeing that every owner of a boiler must have a proper certificate before he can use it, independently of the present system of boiler insurance. He also pointed out that the directors had been much indebted to Mr. Wm. Campbell, C.E., for the careful analysis of the bill which he had drawn up. The reports were adopted. Mr. G. R. Brewis moved, and Mr. John Lamb seconded, that the retiring directors, Ald. Gray and Mr. George Bradford, be re-elected. Agreed to. Mr. J. A. Baty and Mr. Thomas Gillespie were re-elected auditors for the ensuing year. The Mayor of Gateshead (Mr. George Davidson) moved a vote of thanks to the chairman. Mr. John Lamb seconded the motion, which was carried. A vote of thanks was passed to Mr. W. B. Campbell, engineer and manager, for his management, and congratulating him on his return to business after his long illness. The proceedings then terminated

Review.

Fleming's Practical and Useful Diary for 1888. Halifax: Messrs. Thos. Fleming, Son & Co.

In issuing this handy little book the publishers, the well-known firm of leather belting manufacturers, of the Westgrove Mill, Halifax, have contrived to put in the 120 odd pages they have devoted to the purpose a vast amount of information likely to be of service to all engaged in commercial pursuits. In addition to the usual information to be found in a diary, the firm have given a complete price list of their numerous products, and a lengthy list of some of the wider driving belts now running, together with the date when supplied by Messrs. Fleming, is also given. From this we notice that one of their 24 in. belts has been running since 1875, while a 78 in. belt by them has been in work since '82. Under the heading of "General Information" much that is useful is given about the Bankruptcy Act, 1883, County Court summonses, days of grace on the Continent; while the hints on mercantile law, &c., are well worth reading by everyone in business. "Hints to users of leather belting" and "Practical facts on belting" should be read by everyone in charge of belts. Among the illustrations some very complex belt drives are shown, which well exemplify the old adage, "There's nothing like leather."

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from February 13th to March 16th, 1888.

2381 J. H. Hall. Steam boiler furnace fire bars.
2421 F. Hargrave. Life buoys.
2422 F. Hargrave. Signalling at sea.
2427 J. N. Cosbey. Saving life at sea.
2439 E. J. Bates. Ships' mattress.
2446 T. Elcoate. Steam engine valves.
2524 Redfern (E. Hulburd). Metallic packing.
2536 S. Alley. Screw propellers.
2550 W. Christie. Checking progress of vessels entering dock, harbour, &c.
2587 E. J. Preston. Ships' side lights.
2589 J. P. Harriss-Gastrell. Compound expansion engines.
2617 G. Donkin and B. G. Nichol. Ships' watertight doors.
2703 F. Hargrave. Sounding at sea.
2704 F. Hargrave. Disengaging ships' boats.
2722 J. M. Banks and J. H. Storey. Preventing collisions at sea.
2723 J. Pain. Ships' signal lights.
2822 J. Foulds. Propellers for boats, &c.
2851 T. Utley. Ships' side lights.
2864 T. Johnson. Serving rope for ships' rigging.
2885 F. J. Sinnette. Watertight seams and butts of vessels.
2931 Lake (B. Arnold). Distributing oil on water.
2936 J. Harper. Screw Propellers.
3051 J. J. Peck. Ships' cabin sash fasteners.
3168 J. Dewrance. Lubricators.
3293 A. J. Loftus and A. G. Angier. Signal lamps for ships, &c.
3353 W. H. & T. Fry. Paddlewheels.
3388 G. Poore and W. C. Storey. Vessels to travel under water.
3429 J. G. Lawrie. Corrugated furnaces.
3501 J. Brookbanks. Composition for ships' bottoms
3569 J. W. Wilson. Steering ships.
3656 E. Lund, Jr. Pulsometers.
3675 J. Walker. Piston and gland packing.
3681 D. Pugh. Tube stoppers for steam boilers.
3693 T. Wilson. Ships' berths.
3711 R. Richardson. Hand and steam steering gear.
3749 P. W. Willans. Driving gear for screw propellers.
3773 W. C. Wallace and R. D. Smillie. Diminishing corrosion of screw propellers.
3825 G. Hey Stuart. Oars.
3854 J. F. Ward. Vessels' rams.
3870 J. Wing. Ships' fittings
3887 Thompson (W. M. Ducker). Boats.
3957 J. Gilmour. Feeding, heating, and circulating water of steam boilers.
3973 A. D. Lewis. Life-saving raft.
4021 E. Crompton and J. T. Cochran, steam boilers.
4027 E. Urry and J. W. Tasker. Hauling gear.

BOARD OF TRADE EXAMINATIONS.

EXTRA FIRST CLASS.

March 3rd, 1888. Pritchard, Ellis. Extra 1 C. Liverpool.
March 3rd, 1888. Trew, James Bradford. Extra 1 C. Cardiff.

Note.—1 C, denotes First Class; 2 C, Second Class.

February 25th, 1888.

Armitage, Wm.	2C	N.Shields
Armstrong, John	2C	Glasgow
Atkinson, John H.	2C	Cardiff
Barr, James	2C	Glasgow
Bece, Peter	1C	,,
Bird, Charles W.	1C	,,
Brook, George	1C	Cardiff
Brown, Alex. M.	2C	Glasgow
Cheyne, M.	2C	,,
Colville, James	1C	Cardiff
Fleming, Wm. R.	2C	Dundee
Fletcher, Thos. D.	2C	,,
Fletcher, John B.	2C	Cardiff
Graham, David	1C	Liverpool
Grant, C. F.	1C	,,
Hoy, George P.	1C	Dundee
James, Frank C.	1C	Cardiff
Lawson, John	2C	Dundee
Lloyd, David	1C	Cardiff
Lowel, Jesse R.	2C	,,
Matthewman, J.A.	2C	Liverpool
McGregor, Jas. S.	2C	Glasgow
McKellar, Archibd	1C	Liverpool
McKillop, John	1C	Glasgow
Mercer, Richard	1C	Cardiff
Napier, Thomas	1C	London
Nicol, John A.	2C	,,
Panton, Wm. Tom	1C	N.Shields
Pathson, John W.	2C	,,
Paulin, W. Heron	2C	,,
Pullar, David	2C	Dundee
Robertson, Thos.	1C	Glasgow
Rogers, John Jas.	2C	Cardiff
Symmington, W.	2C	Liverpool
Venus, Fred. R.	2C	N.Shields
Ward, Alex. A.	2C	Cardiff
Wedlake, Thos. H.	2C	,,
West, Geo. J. G.	1C	Glasgow
Wilson, James	1C	,,
Wyllie, James C.	1C	,,

March 3rd, 1888.

Canrobert Vic. P.	1C	N.Shields
Clark, John	1C	Sunderl'd
Collins, John T.	1C	N.Shields
Craig, Andrew	1C	Aberdeen
Cuypers, H. G.	2C	London
Davis, David	2C	N.Shields
Dove, John James	2C	Sunderl'd
Fletcher, Ellis	1C	Liverpool
Frail, Richard	1C	Sunderl'd
Hamilton, George	2C	Aberdeen
Innes, John	1C	Sunderl'd
Johnson, Hugh	2C	Aberdeen
Joss, Peter	2C	,,
Moir, Archibald	2C	,,
Nichol, David B.	1C	Sunderl'd
Nicholson, Fred.	2C	,,
Pirie, George	1C	Aberdeen
Postlethwaite, W.	1C	Liverpool
Royal, Robert	1C	N.Shields
Scott, Thomas J.	1C	Liverpool
Smith, Robert	2C	,,
Smith, Davidson	2C	N.Shields
Swinton, A. C.	1C	London
Todd, Henry	2C	Hull
Towers, Walter	2C	London
Villamil, C.	1C	Sunderl'd
Watson, Peter	2C	Aberdeen
Wylie, Ed. S. S.	2C	N. Shields

March 10th, 1888.

Allan, Peter	1C	Greenock
Andrews, Geo. J.	1C	Glasgow
Bahnsen, S. P.	1C	London
Bell, Allan	2C	Liverpool
Black, William	1C	Leith
Brindle, Seth	2C	Bristol
Corakides, George	1C	Leith
Davidson, M. J.	1C	,,
Davidson, John	1C	London
Davies, David T.	2C	Liverpool
Donaldson, R. W.	2C	Leith
Duncan, William	2C	,,
Forbes, Henry	2C	London
Glen, John	2C	,,
Gordon, John A.	1C	Bristol
Hayes, David	1C	Belfast
Hendry, John	2C	Leith
Jeffrey, Alfred E.	2C	Liverpool
Lang, John	1C	London
McLean, Alex.	2C	Glasgow
McMain, Alex.	2C	Leith
Miller, Robert M.	1C	Glasgow
Millis, Thomas G.	2C	Liverpool
Nicholson, George	1C	N.Shields
Renfrew, Andrew	1C	Glasgow
Roberts, C. W.	2C	Greenock
Roger, W. M.	2C	Glasgow
Scott, William	2C	Leith
Smith, Luke	1C	Glasgow
Stirling, Alex.	1C	,,
Twizell, Wm. E.	2C	N.Shields
White, William	2C	,,
Wilson, John	1C	Glasgow

March 17th, 1888.

Arundell, A.	2C	Hull
Berry, W. G.	2C	,,
Bonning, Alfred	2C	London
Colihet, Jacobus	2C	,,
Fairhurst, John	2C	Liverpool
France, Alfred B.	1C	W.H'pool
Gray, Robert	1C	Dublin
Girdwood, A.	2C	Dundee
Hale, Wm. John	1C	N.Shields
James, Nicholas	2C	Plymouth
Jones, Isaac T.	2C	W.H'pool
Lucock, Robert T.	1C	Liverpool
Maider, John	1C	Hull
McArt, George	1C	Liverpool
Rees, John	2C	London
Richardson, R. J.	2C	,,
Robbie, F.	1C	Dundee
Robinson, T. W.	1C	London
Rothery, George	2C	Liverpool
Samuel, M.	2C	W.H'pool
Sykes, Tom.	1C	Hull
Wemuss, G. B.	1C	Greenock
Whitehead, W. R	2C	Hull.

Erratum.—Blundell, W. H. 2C should read 1C.

PATENT HOPPER DREDGER.—William Simons & Co., of Renfrew, have received another order for one of their Patent Hopper Dredgers for harbour improvements in the East.

The Marine Engineer.

LONDON, MAY 1, 1888.

EDITORIAL NOTES.

THE rise of working pressure of boilers in the navy, by reason of the introduction of exceedingly high rates of expansion of steam in the engines, has created considerable interest as to the proper test pressures and factors of safety to be used in the present high-pressure boilers, so as to give ample security without excessive weight. It is well to remember that the whole question depends upon the necessity or advisability for the employment of the very high ranges of expansion for which a high initial pressure is necessary. We have heard rumours in many quarters that the excessive rates of expansion, now becoming rapidly popular, have not in all cases produced the economical effects sought for. We would therefore suggest that there is such a thing as carrying excessive rates of expansion so far as to cease to obtain further economical advantage from them, beyond a certain limit; and that, because economy results from a certain increase in the range of expansion, it does not follow that a corresponding increased economy would ensue from further increase of expansion in a smaller degree. We may roughly define our idea of this subject in this way. It is well known that any engine, and particularly a marine engine, absorbs a considerable percentage of the whole power that it develops in driving what we may term the dead load, represented by its own friction and that of the propeller shaft and propeller. Thus a certain proportion only of the whole power remains as net effective power to produce speed. This loss on dead load may we think be estimated at about one-third of the whole power. If now the work in the engine, or in any cylinder of a triple or quadruple expansion engine, should fall below the minimum power required to drive the dead load of the engine and propeller, there cannot be any net result during that period of the revolution from that particular cylinder or cylinders, and the continued work of the engine is conducted by that cylinder or cylinders in which the working pressure remains at a high point, subject to the drawback of uselessly driving that cylinder or cylinders in which the work by undue expansion may have fallen below an effective limit. The employment of steam with excessive expansion always means that the time and consequent number of revolutions of the engine, during which a given weight of steam is developing its power, is increased, and carrying our idea to its ultimate *reductio ad absurdum*, it is possible to conceive of the effect of steam being so spun out by extreme expansion as to be occupied during three-fourths of its whole portion in driving nothing but the dead weight alone. This must evidently be the opposite to an economical employment of the steam. With a single cylinder engine such a result is hardly likely to occur, since the irregularity of the work between initial pressure and ultimate pressure at extreme expansion would be so great as to lead to too much irregularity in the driving power of the engine. When, however, two, three, four or more cylinders are combined together to drive a single shaft, those cylinders in effective operation at high pressure serve to reinforce and carry on the rotation of the shaft during the periods when some of the cylinders may actually be doing no effective work at all—that is, no margin of effective work above the minimum which is required to drive the dead load. Under such circumstances we hold that the net effect of the steam employed up to excessively great ranges of expansion is less than were it employed at more moderate ranges of expansion so as to obtain from the steam a more concentrated effect in a given time. It must be remembered that if steam be utilised by expansion, say, for one-half revolution of the shaft in one case and in another the same steam is utilised by double the expansion for two strokes, that is, for a complete revolution of the shaft, the steam in the second case has double the amount of dead load to overcome before there is any net balance of work than in the former case, and if the latter part of the work done by the steam should be less than that required to overcome the dead load, rotation can only be maintained by reinforcement from a fresh supply of power, which is thereby robbed of a portion of its effective work. We think this may have a good deal to do with the doubts and queries, which we hear rumoured, as to the economy, which it was believed attached to the employment of triple and quadruple expansion engines.

THE well-known launch and torpedo builder, Mr. A. F Yarrow, submitted an entirely novel idea for marine propulsion for such boats, before the Institution of Naval Architects. He described an experimental launch which he had just completed to effect the driving of the engine by the volatilisation of a hydro-carbon oil. The boat is 36 ft. in length by 6 ft. beam, and is built of steel. The

whole weighs 14 cwt., and the machinery 6 cwt. The engine used is of the ordinary direct acting inverted type, with the usual link motion and feed pumps. The generator, however, is something entirely novel, consisting only of a copper coil enclosed within a double sheet-iron casing, and provided with a ring Bunsen burner underneath it, in which hydro-carbon oil may be economically burnt to effect the evaporation of the hydro-carbon oil in the coil. A copper tank, containing 40 gallons of hydro-carbon oil, is carried in the bow of the boat, and is placed in communication with the feed pumps by a pipe passing outside the boat close to the keel. The exhaust from the engine passes into two condensing pipes placed longitudinally one on each side of the keel, thus utilising the sea water for condensing purposes without any special circulating pump. There are two hand pumps to start the apparatus; one pumps the hydro-carbon from the tank and forces it into the bottom of the coil, the other forces air into the top of the tank, which, becoming charged with vapour, is carried to a supplementary burner under the vapour generator, and arranged to ignite the main burner directly it comes into operation. As soon as the air charged with vapour finds its way to the supplementary burner, it may be ignited, and the supply of air is maintained by the hand pump for two to six minutes until the coil is thoroughly warmed up. The heat so developed in the coil immediately develops pressure therein, which suffices to force the hydro-carbon through the main burner, where it is ignited by the auxiliary burner. When this has been fairly started, a hand air-pump is no longer needed, as the coil, maintaining its pressure automatically, supplies the burner with hydro-carbon oil and air. The hydro-carbon in the coil rapidly evaporates, and is carried to the engine by the usual steam pipe and cock; and as soon as the engines are running the feed pumps are set to maintain a regular and proper supply of hydro-carbon to the evaporating coil and burner. From this time the action throughout is found to be regularly automatic, no further attention or stoking being required. A working pressure of 70 lbs. per square inch can easily be maintained, and the hydro-carbon vapour used in the engine is recovered by condensation, and is forced back by the feed pumps into the tank, the sole waste of the oil being in the way of fuel burnt in the Bunsen burner. There are evidently several very important points in this system. The weight of the boiler is almost entirely avoided, that of the generating coil described being very small, as it is so light that two men can easily lift it. Hand firing is abolished, the fuel being automatically fed. Owing to the absence of coal the whole arrangement is extremely cleanly, and one person with ease and comfort can take entire charge both of the steering and management of the machinery. As there is no sedimentary deposit from the oil in the cylinder, and it will help the lubrication of the parts, this system promises great things. The temperature of evaporation is also very low, consequently the generator is expected to be vastly more durable than the ordinary boiler. Mr. Yarrow promises further particulars of the thermo-dynamic value of this system, when his experiments are more fully carried out. These we shall await with great interest.

ANY information which will tend to reduce the number of disastrous collisions at sea, which are now so strikingly numerous, will be very welcome both to sailors, ship-owners, and others. We have often expressed our opinion that the large modifications in size and tonnage of the present liners and ironclads have led to conditions quite different in their effect to those affecting the old-fashioned wooden sailing vessels. Captains, therefore, or officers in charge of the deck, are, we believe, often deceived as to the danger into which they ignorantly run, until collision is too inevitable to be avoided. Some very interesting notes on these points have been communicated by J. H. Heck, Esq., to the Institution of Naval Architects, and we are not surprised to hear that masters who have been induced to make trials at sea in reference to the distance in which a steamer can be brought up by the reversing of the engines, or the distance at which two vessels may clear each other by porting the helm, were considerably astonished at the results, and expressed a belief that similar information, if more generally known by sailors, would tend to reduce the number of collisions and strandings. The present tendency to concentration of mass in powerful steamers is of the most vital importance to this question, so that it is found that a small steamer going at full speed is under more rapid control than a larger vessel going at half speed. In fact, this influence of size was pointed out as far back as 1878, by a committee of the British Association, which investigated the effect of propellers on steering screw steamers. They report that "it appears, from experiments made by the committee and from other evidence, that the distance required by a screw steamer to bring herself to rest from full speed ahead by the reversal of her screw, is independent, or nearly so, of the power of the engines, but depends upon the size and build of the ship, and generally lies between four and six times the ship's length." There

seems also to be no general understanding as to what is meant by a moderate rate of speed enforced by the regulations of the Board of Trade to prevent collisions in fog, mist, or falling snow. The important fact of a reduction of speed increasing the control over a steamer seems to be very much under-estimated by seamen. The conclusions Mr. Heck has been able to arrive at are somewhat striking, and define that where two vessels of similar size and displacement have different maximum speeds, that vessel with the faster maximum speed is under greater control than that with the lesser speed, when their speeds of travel are alike. A vessel in light condition is under better control than when loaded, and the smaller the vessel with a given speed, the better is its control at that speed. It should be noted also that steamers travelling at ordinary speeds will go a very considerable distance, not less than 20 or 30 lengths, before coming to rest, if the engines are simply stopped, and not reversed. It would be well if these respective distances were accurately ascertained on the ordinary speed trial trips, so that captains in charge of them should be able more accurately to judge their distance as to the possibility of checking movement, or whether it might not be better to keep up speed with helm hard aport. This would depend almost entirely upon the rate of speed at which the vessel was travelling when the collision or running on a coast was imminent. With a high rate of speed it would probably be best to put the helm up hard ; with half speed or moderate speed it might produce more prompt effect to reverse the engines. It is obvious that absolute information, derived from direct tests on these points, to the captain or officers in charge of a vessel on which they could instantaneously act with certainty, might make all the difference between disaster and safety.

FORCED DRAUGHT.*

By J. R. FOTHERGILL, Esq., Member.

FORCED draught, or the mechanical supplying of air above atmospheric pressure, for the purpose of combustion in steam boilers, has for some time been a question of much controversy, more especially in its application to the marine boiler.

Engineers, from the want of reliable data gained from actual experience, hesitate to accept the doctrines propounded in the numerous papers which have been brought forward, and shipowners will not move without substantial evidence of a commercial gain; and thus the writer hopes the data he is enabled to lay before you will create some confidence, and lead to a better appreciation of this important subject.

The application of forced draught is not by any means a new idea, for we find in 1830 John Ericsson applied a fan to the steamer *Corsair*, trading between Liverpool and Belfast; and although he claimed to be the originator of the fan-blower system for steam vessels, yet the application appears to have been only experimental. Since then to the present time many modifications have been made, but, from one cause or another, do not appear to have given that success which their originators anticipated; and it is only within the last three or four years substantial progress has been made.

To attempt a general description of what has been done, or even to refer to the many proposed adaptations to the various types of boilers, however interesting, would occupy more time than the present occasion will admit. The writer thinks it will be more in accord with the meeting if he deals with the subject in its application to the furnaces of marine boilers only; and he is of the opinion that, in the general application of forced draught to the Mercantile Marine (more especially to cargo steamers) the "closed ash-pit" system offers advantages not possessed by the system of "closed stoke-hole." And this is more particularly the case when altering existing steamers, in which the question of first consideration is the capital outlay.

The use of forced draught does not involve new principles in chemistry, but enables us with greater certainty to carry out those conditions which chemistry shows are essential to produce a perfect or more complete combustion, or union of the gases, and thus obtain a higher efficiency per pound of fuel consumed than can be obtained by natural draught; and this is more especially the case with the ordinary type of marine boiler.

The chemistry of combustion has been so often expounded in prior papers read before this Institution that it does not appear necessary on this occasion to do more than touch upon the essential features bearing upon the question.

The quantity of air at 62° Fahr. required for the chemical combustion of 1 lb. of average coal is 140·6 cubic feet, or by weight 10·7 lbs. In the ordinary type of multitubular marine boiler under natural draught 20 to 24 lbs. must be supplied. This enormous excess reduces the furnace temperature, and, in leaving the boiler, carries away a large percentage of the heat, which in units of heat may be estimated at 20 per cent. when the air supply in pounds is 24 to 1 of coal and the funnel temperature 600° Fahr.

If we restrict this wasteful supply the result is worse, for without a large excess for the dilution of the gases the chemical union of the oxygen with the carbon to the production of carbonic acid cannot be effected, and thus carbonic oxide is formed, and only 4,400 units of heat evolved from 1 lb. of carbon, instead of 14,500 units by the formation of carbonic acid.

There is also the important question, the velocity of the gases. It is necessary that not only should time be allowed for the transmission of heat to the boiler, but it is absolutely essential time should be given to effect that union of the gases required to produce perfect combustion.

In ordinary practice, with natural draughts and the usual proportioned funnel, in which the gases have a temperature of 600° Fahr., the velocity of the gases may be estimated at 40 ft. per second, which is sufficient to prevent complete union of the gases under the general conditions of air admission, for it must be borne in mind complete combustion can only be effected during the passage of the gases between the furnace and the entrance to the tubes, the time so occupied being about the fifth or sixth part of a second. We thus discern, if perfect combustion is to be effected, not only the quantity of the air supplied, but the manner in which and where it is supplied, which is of the most vital importance.

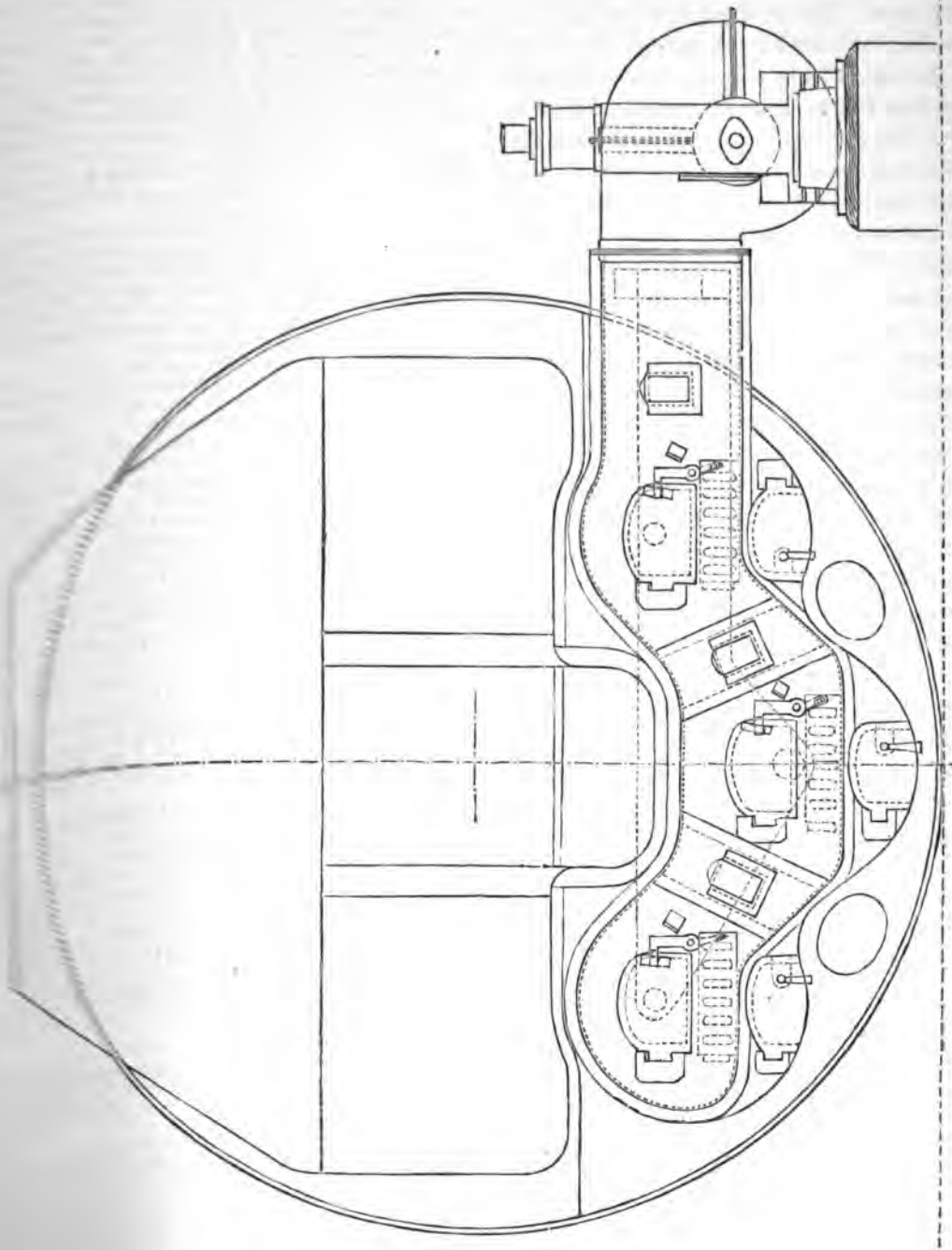
Scientifically, we know definite quantities of air are required for the gases and for the fixed carbon or coke, and yet in general practice the difficulty of complying with this important requisition under the ordinary conditions of natural draught appears insurmountable.

As the air enters the fire from the ash-pit, its oxygen combines with the incandescent fuel on the bars, generating great heat, in the formation of carbonic acid, which, in passing upwards through the glowing coke, takes up an additional portion of carbon, producing carbonic oxide with considerable reduction of temperature.

If the carbonic oxide thus produced cannot, as it leaves the fuel, find and unite with another portion of oxygen before it enters the tubes, it escapes to the atmosphere, and we sacrifice about 60 per cent. of heating power.

By the mechanical supplying of air under pressure, we can not only regulate the quantity at will, but, what is of greater importance, the distribution; and furthermore, when the air is forcibly brought into contact with the incandescent fuel and heated gases, the oxygen more readily unites with the carbon, and by regulating the position of the funnel damper we are enabled to reduce the velocity of the gases to a minimum, whereby the oxygen and the carbon are brought into close contact, and time is permitted for their union and for the transmission of heat to the boiler.

*Read at the Twenty-ninth Session of the Institution of Naval Architects, on March 23rd, 1888.



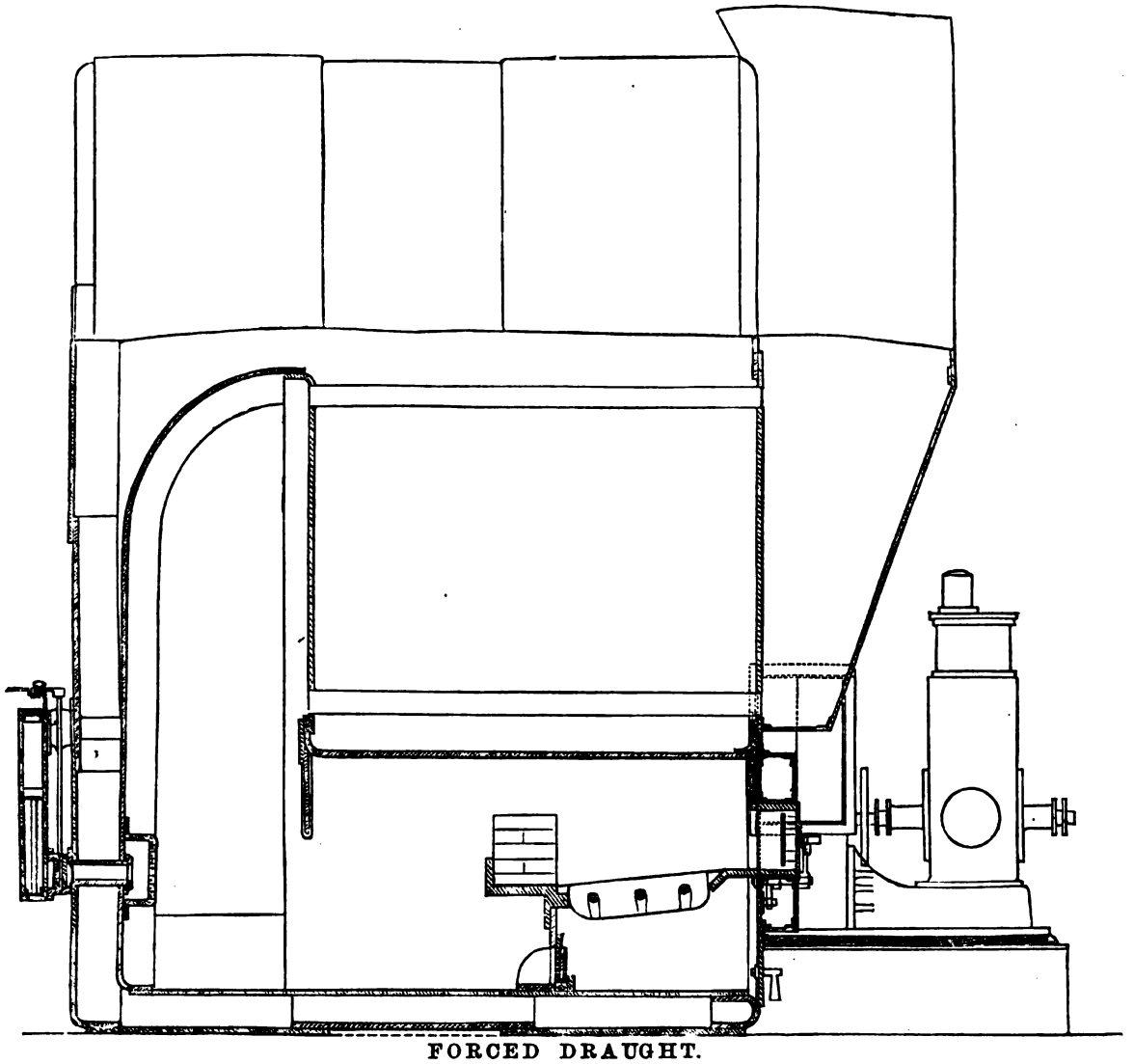
FORCED DRAUGHT.
Scale ¾ Inch to a Foot.

The adaptation of these principles to commercial success necessitates the careful consideration of other important conditions, particularly in the application to existing boilers, more especially of cargo steamers.

The cost of the application must not be excessive; the arrangement such as to allow of ready removal for repairs to boilers, and strong enough to stand stokehold usage and stand the continuous work of long voyages, must not affect the present arrangement of stoking, and admit of steaming under natural draught without stopping for alterations, should the apparatus break down, which possibility is incidental to all machinery.

opened. When the door is shut, of course the latch is pulled over to fasten the door, thus opening the valve. The door is of the ordinary type, and does not at all interfere with the common practice of stoking. A casing extends across the back of the boiler, and is connected with the front casing by a pipe running along the boiler side. To the mouth of this pipe, where it joins the front casing, an adjustable scoop is fitted to regulate the air supply. Connected with this back casing are air pipes through the boiler back into the combustion chambers.

The mouths of these pipes in the combustion chambers are covered by a cast-iron perforated box, to admit the air in jets.



FORCED DRAUGHT.

Scale ⅜ Inch to a Foot.

The drawings illustrate the general features of the writer's system. A casing connected with the fan extends across the boiler front, and is so constructed in separate parts that each part covering a furnace mouth can readily be removed without necessitating the removal of any other part. The air is forced into this casing, and finds its way into the ash-pits through the gridiron valves in the back plate of the casing, just under the line of fire-bars. These valves are actuated by the movement of the furnace door latch. When the latch is pulled or knocked back against the stop, the lever on the same spindle as the latch causes the valve to close, thus shutting off the air supply to the furnace before the furnace door can be opened, thereby preventing the hot gases and flame being forced out of the furnace when the door is

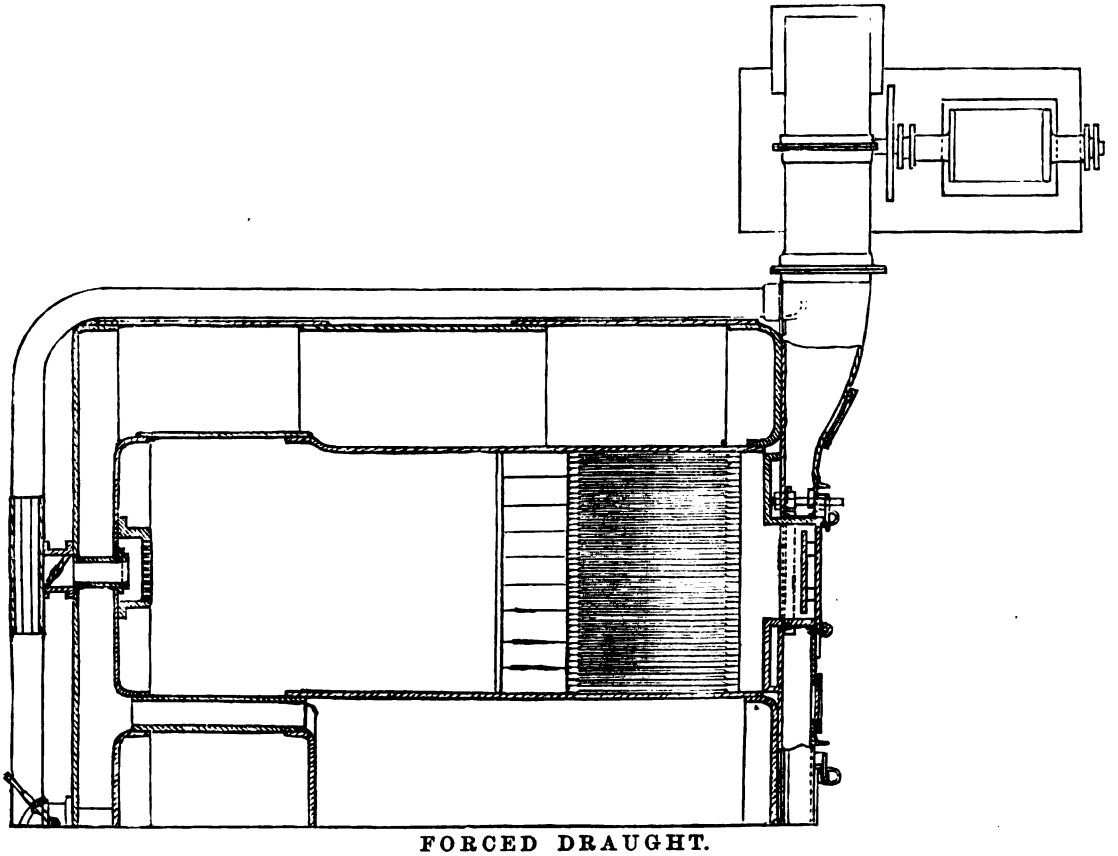
The other ends of the pipes are joined to the air casing by short cast-iron connections fitted with regulating valves. To admit of access to the ash-pits, doors similar to those of the furnaces are fitted, and at the end of the ash-pits there is fitted a special arrangement of air boxes, perforated with small holes for the admission of air under the bridges, and the quantity of air admitted is regulated by a perforated slide. At the front side of these boxes there are projecting pieces, or lugs, by which they can be withdrawn, and thus allow the combustion chamber bottoms, when necessary, to be raked out in a very short time. The fire-bars are riveted together in sets of three or four to prevent warping or twisting. At the end of the grate there is the usual brick bridge, and behind this bridge a gas deflection is fixed.

The air leaves the fan at 3 to 3½ in. water-gauge pressure, and in its passage to the furnace a portion is supplied to the casing at the back of the boiler, which due to the size of this casing and the deflecting scoop, the pressure is maintained, and the air enters the tubes through the boiler back at the same pressure as it leaves the fan. The main bulk of the air passes on to the ash-pits, where we have a water-gauge pressure of ·5 to ·7 in., depending on the condition of the fires.

As the gases leave the fire and pass over the bridge they are deflected, and the air from the back casing, rushing at great velocity through the perforated plate in very small streams, acts, as it were, like so many air pokers, stirring up the gases, commingling and uniting with them most effectively. The quantity of air so admitted can be supplemented, in case of need, from the ash-pit through the air-box under the bridge.

wretched coal occasionally supplied at various foreign ports; but most important of all is the gain whilst cleaning fires. Many of you are well aware—more particularly in the case of cargo boats—that steam cannot be maintained whilst cleaning fires without reducing the speed of the engines, and frequently it is nearly an hour before full pressure is obtained. With forced draught and short grates the fires are quickly cleaned, and within a very short time the power of the blast burns the fire into good condition. Whilst cleaning a fire, steam is readily maintained, for the blast being shut off that fire increases the pressure in the other ash-pits, and thus good steam can not only be maintained, but the coals are efficiently consumed.

It is the writer's practice, when the coals are fairly free from clinkers, to draw from the fire clinker whenever felt, and never clean a fire at stated periods.



FORCED DRAUGHT.

Scale ⅛ Inch to a Foot.

This question of air admission to the gases is of the utmost importance. If the air is admitted in a body or sheet it cleaves its way through the gases, does not mingle with them, and produces a cooling effect; but when broken up into small streams and admitted with force, it completely penetrates the gases without chilling, and thoroughly stirs them up; the additional quantity of oxygen is admitted, and combustion completed.

By the use of the deflecting plate, not only are the gases as they leave the fire prevented from passing along the furnace crown direct into the tubes, but the lower part of the combustion chamber is, to a great extent, utilised as heating surface.

Although the question of air supply is of the utmost importance, and not to be neglected, yet it does not by any means comprise the whole question of economy due to the application of forced draught. There are other great advantages, which may be called "mechanical," in contradistinction to the chemistry of combustion. For instance, combustion is rendered independent of weather or climate, which is of immense advantage and gain in light following winds and hot climates. Under natural draught, the overpowering exertions of the firemen fail to get steam, and coals are consumed to low evaporative efficiency. Then, again, with forced draught we are better able to carry steam with the

Due to these causes we are enabled to increase the ship's speed on the same consumption, or ease the engines and maintain the same speed of ship with a saving in coal.

The writer cannot give any definite rule as to grate area, this depending upon several considerations, more particularly when altering existing boilers. The first consideration is the quality of coal intended to be used. It is impossible to burn "Duff" on a grate area arranged for screened coal. Then arises the question of increased speed or reduction in consumption.

A continuous record of the funnel temperature should be kept, and this is of great importance, as it clearly indicates what is going on in the furnace, and the best guide not only to the air supply, but to the most efficient area of grate.

In some systems of forced draught the air, before being forced into the ashpits, is made to circulate through or about a series of tubes or passages in direct contact with the hot waste gases as they pass to the funnel. There can be no question every unit of heat so obtained and returned to the furnace is a unit of heat saved, but nothing more. The writer is of the opinion the extra cost of fitting a special apparatus, and the increased fan power necessary either to overcome the friction of driving the air through or about a number of small tubes without reduction of pressure,

or to pass an extra volume through the fan due to the expansion of the air by heat, much exceeds the value of the heat so obtained.

There is also another question which does not appear to have had that consideration it deserves. Take a steamer trading to India, say the *Hypatia*, where the fan is at the bottom of the engine-room, and passes from 8,000 to 10,000 cubic ft. of air per minute. The whole of this air supply has to pass down the engine-room skylights, with the result the engine-room, even in the Red Sea in the hottest weather, is quite cool—which I think you will admit, is of great value. Again, the air passing through the casing on the boiler front absorbs the radiated heat in its passage to the ashpits, and the casing is always cool, and thus the stoke-holds are never hot.

The question of efficient fans and the best method of driving them is of serious consideration. The writer has tried various types of engines, driving the fans by leather belts, cotton ropes, friction gear, and direct acting, but for some time past has used Chandler's combination of high-speed engine and fan, driving direct, with the most satisfactory results, running night and day continuously. As an instance, in the *Hypatia*, the fan and engine ran twenty-four days and nights continuously, without once being stopped or giving the slightest trouble.

Having somewhat fully dwelt upon the principle of forced draught, the writer now proposes to lay before you the commercial results of his experience.

In 1884 the writer first applied forced draught to the s.s. *Marmora*. The result proved so satisfactory that when the s.s. *Stella* was built, in 1885, it was decided forced draught should be applied. Messrs. Wyllie & Morison's system, which admits the air practically the same as in the *Marmora*, was fitted, but by this system the air is heated by the waste gases of the funnel. After the *Stella* followed the steamers in the order named in Table I. These steamers are fitted with the writer's system.

Table I. gives particulars of the steamers, including engines and boilers, and the year in which they were forced-draughted.

By reference to this Table you will observe the steamers vary in size from 1,250 to 3,600 tons deadweight carrying capacity, and they are in the Indian, Mediterranean, and South of Spain trades. The engines are compound or triple, working under boiler pressures of 65 to 160 lbs.

Tables II. to XII. give full particulars relative to the coal consumption of the steamers *Marmora*, *Dania*, and *Etna*, and illustrate the advantage of forced draught as applied to the consumption of "inferior coal" in the *Marmora*, "good coal" in the *Dania*, and "increased speed" in the *Etna*.

In these Tables no allowance has been made for bad weather, indirect courses, or other incidents much experienced in the "Bay" trade.

The mean speed in knots are the days steaming into the distance taken over the whole period, and therefore not what is generally known as the speed of a steamer—*i.e.*, as taken by log in fine weather.

From the following summary of results taken from Tables II., III., and IX.:—

S.S. *MARMORA*.

Summary of Results.

Conditions.	Days Steaming.	Knots per Hour.	Consumption per Day Steaming.	Consumption for all purposes per Day Steaming.	Total Cost of Bunkers per Voyage.
Natural Draught.					£ s. d.
Mean of 12 voyages ...	16·81	7·74	8·72	10·52	78 7 0
Forced Draught.					
Mean of 11 voyages ...	16·69	7·48	8·49	9·79	44 19 8
Comparative results ...	—	−·26	·23	·73	33 7 4

—we find, taking 11 voyages forced draught as against 12 voyages natural draught, a ¼-knot reduction in speed and a saving in coal; but there was a saving per voyage of 42½ per cent. effected in the cost of the bunker coals, equal to £33 7s. 4d., and as this steamer made 11 voyages in 12 months, the saving per annum due to burning inferior coal was £367.

As it may be estimated the reduction of ¼-knot in the speed produced the saving of ¾ ton per day, equal to 13 tons per voyage; therefore, with the object of avoiding possible inaccuracy, the value of this difference had better be deducted from the £367, thus reducing the saving per annum to £330.

Although the difference in price between good and inferior coals was at that date sufficient to effect the above saving, yet at the present day the difference is much less, therefore the saving at present prices may be estimated at £270 per annum.

In the *Dania* a fairly good coal was used (see Tables IV. and V.), and so far as possible the same class of coal was obtained each voyage.

The following summary of results are taken from Tables IV., V., and X.

S.S. *DANIA*.

Summary of Results.

Conditions.	Days Steaming	Knots per Hour.	Consumption per Day Steaming.	Consumption for all purposes per Day Steaming.
Natural Draught.				
Mean of 13 voyages	16·31	7·91	9·84	10·96
Forced Draught.				
Mean of 8 voyages	16·89	7·44	7·66	9·27
Comparative results	—	−·47	2·18	1·69

Taking 8 voyages forced draught as against 13 voyages natural draught, we have a reduction in speed of nearly ½ knot. A saving in the consumption per day steaming of 22 per cent., and a saving in the consumption for all purposes per day steaming of 14·5 per cent.

The whole of the forced draught voyages were made during the winter months (see Table V.), and the loss of speed was principally due to that cause, as shown by the following comparison, in which the voyages are taken during the same months, *i.e.*, September to February.

S.S. *DANIA*.

Second Comparison.

Conditions.	Days Steaming.	Knots per Hour.	Consumption per Day Steaming.	Consumption for all purposes per Day Steaming
Natural Draught.				
Mean 4 voyages, 102, 103, 104, and 105...	17·00	7·50	9·73	10·70
Forced Draught.				
Mean 4 voyages, 113, 114, 115, and 117...	16·21	7·58	7·76	9·31
Comparative results	—	+·08	1·97	1·39

From this comparison we find the speed practically the same, and in round figures a saving in the consumption per day steaming of 20 per cent., and a saving in the consumption for all purposes per day steaming of 13 per cent.

Taking the average length of voyage at 16 days and 11 voyages per annum, we have a saving as follows:—

Saving per annum on consumption for all purposes per day steaming:—

16 days × 11 voyages × 1½ tons = 264 tons at 7s. 6d net £99 0 0
One fireman less, at £6 per month = per annum .. 72 0 0

As less bunker coals are required more cargo is carried, and the gain due to this, per annum, is as follows:—

264 tons extra cargo carried outwards.
132 ,, ,, ,, ,, homewards.

Net freight on 264 tons outwards less cost per ton discharging cargo	£59	7	8
Net freight on 132 tons homewards, less cost per ton discharging extra corgo	45	16	1
	£105	3	9
It is estimated the shipping and discharging of this cargo will cause a loss during the voyages of 1½ days = ...	20	2	0
	£85	1	9

S.S. *DANIA*.

SAVING PER ANNUM DUE TO THE APPLICATION OF FORCED DRAUGHT.

	£	s.	d.
Saving in bunker coals	99	0	0
Firemen less	72	0	0
Extra cargo carried	85	1	9
Net gain per annum	£256	1	9

In the *Etna* we have a different case altogether, for this steamer was first converted to triple compound and forced draught afterwards. Although the writer does not wish in this paper to at all enter upon the question of "tripling," yet he considers it necessary to put before you natural draught data, that you might be better able to appreciate what has been done.

The following summary of results are taken from Tables VI., VII., and *XI.*:—

S.S. *ETNA*.

SUMMARY OF RESULTS.

Conditions.	Days Steaming.	Knots per Hour.	Consumption per Day Steaming.	Consumption for all purposes per Day Steaming.
Natural Draught.				
Mean 10 voyages	21·95	7·83	10·58	11·58
Mean 3 voyages	27·75	7·58	7·37	8·33
Comparative results ..	—	—.25	3·21	3·25

We thus see the speed was reduced by ¼ knot, and a gain in the total consumption of 28 per cent. due to "tripling."

The following summary of results are taken from Tables VII., VIII., and XII.

S.S. *ETNA*.

SUMMARY OF RESULTS.

Conditions.	Days Steaming.	Knots per Hour.	Consumption per Day Steaming.	Consumption for all purposes per Day Steaming.
Mean 3 voyages "Tripled"	27·72	7·58	7·36	8·33
Mean 6 voyages "Forced Draughted"	23·32	8·38	7·06	7·97
Comparative results ..	—	+·80	·30	·36

It will thus be seen the speed has increased a little more than ¾ knot, and a saving of 4·3 per cent. in the total consumption per day steaming, due to forced draughting. But for voyage 76 (see Table VIII.) in which the coals proved wretchedly bad, increasing the consumption a ton per day, also voyage 77 (see Table VIII.), in which the exceptional bad weather experienced materially reduceed the speed, the results would have proved much better; however, taking the increased speed as given in the above Table, and not considering the saving in consumption, we practically gain one steaming day in nine, or 24 steaming days per annum, equal to a saving of £360 per annum.

Throughout the whole of these trials there was no alteration of propeller, but the same propeller was retained in each case; nor yet, in the case of the *Marmora* or *Dania*, were any alterations made to the engines which could effect the steam used. The engines and boilers in each of the three steamers are by Messrs. Blair and Co., Stockton-on-Tees, and the *Etna* was tripled by the same firm.

Although the application of forced draught only affects the consumption so far as the main boiler is concerned, yet the writer, fully appreciating the difficulty in apportioning the correct quantities used for other purposes than the propulsion of the vessel, considered it advisable, from a commercial point of view, to base the saving due to the application of forced draught on the total quantity of coal used per voyage for all purposes.

If the saving in the consumption for propulsion only had been taken as the basis of comparison, the *Dania* would have shown a much larger gain per annum, and taking into consideration the difficulty of obtaining suitable small coal—more especially free from clinker—for steamers which do not always bunker in the same place, the writer is of the opinion it is more economical with compound engines to use a fairly good coal and reduce the consumption, and due to the reduced quantity of coals used with triple compound engines, the writer believes it more economical to increase the speed.

The *Hypatia* has just completed her third Indian voyage, during which she has steamed in all 253 days, and of course the greater part of her bunkers have been taken abroad. There is a slight increase in the speed, and a saving of 13 per cent. in the consumption.

Forced draught was applied to the *Stella* when built, and also to the *Hecla* when being converted to triple-compound, and thus the actual gain due to forced draught cannot be given, although the *Hecla*, as you will see in Table I., is practically a sister ship to the *Etna*, and engined and tripled by the same firm, and so far shows equally as good results. The *Hilda* has not yet run long enough to say anything definite.

In conclusion, the writer wishes to point out that his principal object has been to show the commercial value of forced draught, more than a consideration of the subject from an engineer's point of view, and he would wish to impress upon you the important fact that the results he has been able to put before you are the outcome of actual work done; and furthermore, that the boilers are not in any way specially designed for forced draught, or in any respect different to the generality of marine boilers.

The writer having seen a letter in one of the technical journals in which the gentleman who wrote the letter takes the credit of having "fitted the first steamer ever worked at sea with forced draught," and also claims to be "the first that ever used forced draught successfully as a normal condition of working in a sea-going steamer," it appears to the writer only right to say the *Marmora* sailed from the Tees on October 3, 1884, whereas the *New York City* did not sail from the Clyde till October 13, 1884, and the data put before you in this paper, it is believed, sufficiently shows the *Marmora* proved a success.

[Great pressure on our space obliges us to hold over until next number the Discussion.—ED. M.E.]

ENGINEERING ACTIVITY IN ITALY.—Speaking of the growth of engineering activity in Italy, a correspondent mentions the works of Gio. Ansaldo and Co., and says:—"At present the place is literally congested with work of every description, and it is hard to know what to do first. Besides a quantity of work for manufactories, &c., there are the engines of 20,000 H.P. for the *Sicilia*, eight sets triple-expansion engines for the *Schichau* torpedo boats, three pair of compound engines of 160 H.P., two of 65 H.P., one of 120 H.P., two sets of launch engines, sixteen six-coupled locomotives, twenty four-coupled locomotives, seventeen locomotives under repair, 10 small boilers, in addition to those above, for the *Regio Marina*, and rudder and tiller gear for five ironclads. This latter is rather a big job by itself."

TABLE I.

PARTICULARS OF STEAMERS AND MACHINERY.

Steamers.	Principle of Build.	Length.	Beam.	Mean Draught.	Dead Weight Tonnage.	Engines.	Year Built.	Cylinders. H.P.	Cylinders. M.P.	Cylinders. L.P.	Stroke.	Present. I.H.P.	Present. Revolutions.
		ft.	ft.	ft. in.	Tons.						Inches.		
Marmora	Spar Deck	214·2	28·2	18 1	1,250	Compound	1874	25⅝	..	51⅝	33	396	64
Stella	Well Deck	302·1	38·1	20 2½	3,625	Triple	1885	22	37½	60	39	853	60
Dania	Well Deck	220·0	29·0	16 4	1,300	Compound	1871—New Boilers 1884	26½	..	50	33	412	61
Hypatia	Flush Deck	285·0	36·0	21 5	3,100	Compound	1882	38	..	70	36	820	56
Etna	Well Deck	235·0	31·1	17 0	1,575	Triple	1874—Tripled 1886	17	28⅛	46½	33	485	65
Hecla	Well Deck	235·8	31·0	16 8	1,500	Triple	1874—Tripled 1887	17	28¼	46½	33	470	65
Hilda	Well Deck	258·5	34·6	19 5½	2,215	Compound	1880	33	..	61	33	630	59

Steamers.	Boilers.	Pressure.	Length.	Diameter.	Total number of Furnaces.	Mean Diameter of Furnaces.	Total Heating Surface.	Trade.	Year Forced Draughted.	Remarks.
		lbs.	ft. in.	ft. in.		ft. in.	ft.			
Marmora	1 single ended	65	8 8½	14 3	4	3 1	1700	South Spain	1884	
Stella	2 single ended	142	10 0	13 9	6	3 0	3498	Indian	1885	
Dania	1 single ended	65	10 0	14 2	3	3 5	1732	South Spain	1886	
Hypatia	1 double ended	80	16 0	15 0	6	3 3	3423	Indian	1887	
Etna	1 single ended	160	9 6	15 0	3	3 6	1862	Mediterranean	1887	
Hecla	1 single ended	160	9 6	15 0	3	3 5	1862	Mediterranean	1887	
Hilda	2 single ended	85	10 0	11 11	4	3 4	2839	Mediterranean	1888	

TABLE II.

S.S. *MARMORA*

TWELVE VOYAGES PRIOR TO "FORCED DRAUGHTING."

Voyage Number.	Voyage.	Distance.	Days Steaming.	Knots per Hour.	Consumption per Day Steaming.	Donkey Steaming.	Raising Steam, Banked Fires, &c.	Consumption for all Purposes per Day Steaming.	Bunkers.						Name of Bunkers.	Total Costs of Bunkers for all Purposes per Voyage.	Date of Voyage.	Remarks.
									Left from last Voyage.	North Country.	Other sorts, including abroad.	Left end of Voyage.	Total Consumption per Voyage Steaming.	Total Consumption for all Purposes per Voyage.				
87	Tyne, Lisbon, Huelva, Hull, and Tyne	3097	16·25	7·94	8·44	15	20	10·6	20·25	162·00	—	10	137·25	172·25	Adair's Main screened	£ s. d. 73 19 9	1883. July to Aug.	
88	Tyne, Lisbon, Huelva, Hull, and Tyne	3097	14·93	8·64	9·08	17	13	11·09	10	161·65	—	6	135·65	165·65	Adair's Main screened	67 0 5	Aug. to Oct.	
89	Tyne, Lisbon, Huelva, Hull, and Tyne	3097	16·08	8·02	9·16	15	15	11·02	6	162·35	15	6	147·35	177·35	Walker's screened Adair's Main screened Welsh abroad	77 19 8	Oct. to Nov.	
90	Tyne, Lisbon, Huelva, London, and Tyne ..	3096	17·93	7·19	8·94	20	20	11·17	6	199·3	20	25	160·3	200·3	Adair's Main screened West Hartley steam Hutton Henry steam Welsh abroad.	100 2 4	Nov. to Dec.	
91	Tyne, Lisbon, Huelva, Hull, and Tyne	3097	19·00	6·79	8·87	16	14	10·45	25	179·6	—	6	168·6	198·6	Adair's Main screened Towneley screened	90 7 11	1883-4. Dec. to Jan.	
92	Tyne, Lisbon, Huelva, Hull, and Tyne	3097	16·85	7·65	8·71	16	14	10·49	6	182·85	—	12	146·85	176·85	Adair's Main screened	70 16 8	Jan. to Feb.	
93	Tyne, Lisbon, Huelva, Hull, and Tyne	3097	15·79	8·17	8·82	15·5	22	11·20	12	174·9	—	10	139·4	176·9	Adair's Main screened	79 19 1	Feb. to Mch.	
94	Tyne, Lisbon, Huelva, Hull, and Tyne	3097	15·95	8·09	8·71	15	20·6	10·94	10	179·6	—	15	139·0	174·6	Adair's Main screened	78 9 0	Mch. to April	
95	Tyne, Huelva, Hull, and Cardiff	3554	19·12	7·74	8·65	11	12	9·85	15	220·5	—	47	165·5	188·5	Adair's Main screened Best S. Yorks. hard stm.	72 10 9	April to May	
96	Cardiff, Gibraltar, Huelva, Hull, and Sunderland ..	2803	14·66	7·96	8·21	13	11	9·85	47	121·5	—	24	120·5	144·5	Welsh	87 10 7	May to June	
97	Sunderland, Gibraltar, Huelva, Hull, and Tyne ..	3265	17·87	7·61	8·43	14	12	9·89	24	157·75	15	20	150·75	176·75	Hutton Henry steam Welsh abroad	76 0 7	June to Aug.	
98	Tyne, Cadiz, Huelva, Hull, and Stockton..	3113	17·33	7·48	8·59	11	12	9·92	20	154·00	—	2	149·00	172·00	South Derwent	65 7 2	Aug. to Sept.	
	Mean Results	3125·83	16·81	7·74	8·72	14·87	15·46	10·52	—	—	—	—	146·68	177·02		78 7 0		

TABLE III.

S.S. *MARMORA*.

ELEVEN VOYAGES AFTER "FORCED DRAUGHTING."

Voyage Number.	Voyage.	Distance.	Days Steaming.	Knots per Hour.	Consumption per Day Steaming.	Donkey Steaming.	Raising Steam, Banked Fires, &c.	Consumption for all Purposes per Day Steaming.	Bunkers. Left from last Voyage.	North Country.	Other sorts, including abroad.	Left End of Voyage.	Total Consumption per Voyage in Steaming.	Total Consumption for all purposes per Voyage.	Name of Bunkers.	Total Costs of Bunkers for all purposes per Voyage. £ s. d.	Date of Voyage.	Remarks.
99	Stockton, Tyne, Huelva, Hull, and Tyne	3091	17·04	7·55	8.27	18	10	9·91	2	177	—	10	141	169	Adair's Main screened	65 4 4	1884. Oct. to Nov.	
100*	Tyne, Huelva, and Start Point	2520	12·64	8·31	8·25	17	8	10·22	10	136·3	—	17	104·3	129·3	Adair's Main small Walbottle small	54 1 8	Nov. to Dec.	
101	Tyne, Huelva, London, and Tyne..	3052	17·14	7·42	9·06	19	10	10·75	17	169·4	—	2	155·4	184·4	West Hartley small	41 2 1	1884-85. Dec. to Feb.	
102	Tyne, Huelva, London, and Tyne..	3052	17·37	7·31	8·51	14	9	9·83	2	174·9	—	6	147·9	170·9	Adair's Main small	37 6 11	Feb. to Mch.	
103	Tyne, Huelva, London, and Tyne..	3052	17·58	7·23	8·00	12	9	9·19	6	170·7	—	15	140·7	161·7	South Hetton small	39 13 11	Mch. to Apl.	
104	Tyne, Huelva, Hull, and Tyne..	3053	16·00	7·95	8·49	10	10	9·74	15	161·9	—	21	135·9	155·9	Whitburn rough	34 16 4	April to May	
105	Tyne, Huelva, London, and Tyne..	3052	16·41	7·74	8·72	13	10	10·12	21	183·1	—	38	143·1	166·1	Adair's Main small South Hetton small	42 4 7	May to June	
106	Tyne, Huelva, Hull, and Tyne..	3053	16·58	7·67	8·55	12	9	9·82	38	166·85	—	42	141·85	162·85	Adair's Main small South Hetton small	41 18 4	June to July	
107	Tyne, Huelva, and Tyne..	3020	17·58	7·15	8·58	8	8	9·50	42	151·00	—	26	151·00	167·00	HuttonHenry unscreened	39 6 9	July to Aug.	
108	Tyne, Huelva, and Tyne..	3020	17·29	7·27	8·44	9	8	9·42	26	126·5	15	4·5	146·00	163·00	Adair's Main small South Hetton small Welsh abroad	49 7 1	Aug. to Sept.	
109	Tyne, Huelva, and Tyne..	3020	18·04	6·97	8·48	8	7	9·31	4·5	155·25	10	1·75	153·00	168·00	Adair's Main small South Hetton small Welsh abroad	49 13 7	Sept. to Oct.	
110	Tyne to Huelva	Wrecked at Huelva				Bar	-											
	Mean Results	299·86	16 69	7·48	8.49	12·72	8·91	9·79	—	—	—	—	141·83	163·46		44 19 8		

* Voyage 100.—When abreast the Start Point, the propeller dropped off, and the ship was ultimately towed to the Tyne.

TABLE IV.

S. S. *DANIA.*

FOURTEEN VOYAGES PRIOR TO "FORCED DRAUGHTING."

Voyage Number.	Voyage.	Distance.	Days Steaming.	Knots per Hour.	Consumption per Day Steaming.	Donkey Steaming.	Raising Steam, Banked Fires, &c.	Consumption for all Purposes per Day Steaming.	Bunkers.						Name of Bunkers.	Date of Voyage.	Remarks.
									Left from Last Voyage.	North Country.	Other Sorts, including Abroad.	Left End of Voyage.	Total Consumption per Voyage Steaming.	Total Consumption for all Purposes per Voyage.			
97	Tyne, Tees, Pomaron, and Tyne	3,055	15·5	8·21	10·74	8	5·5	11·61	20	180	—	20	166·5	180	Adair's Main unscreen'd	1885. April to May	
98	Tyne, Lisbon, Pomaron, Hamburg, and Tyne ..	3,597	18·25	8·21	10·49	15	5.5	11·61	20	170	30	8	191·5	212	Towneley unscreened / Abroad N. Country	May to June	
99	Tyne, Lisbon, Pomaron, and Tyne	3,084	15·5	8·29	10·17	9·25	6	11·16	8	175	—	10	157·75	173	Towneley unscreened	June to July	
100*	Tyne, Savona, Pomaron, and Tyne	5,013	24·25	8·61	8·74	9	6	9·36	10	232	—	10	212	227	Harton unscreened	July to Aug.	
101	Tyne, Oporto, Pomaron, and Tyne	3,062	16·33	7·81	9·7	9·5	11	10·96	15	159	20	15	158·5	179	Adair's Main unscreen'd / Welsh abroad	Aug. to Sept.	
102	Tyne, Oporto, Pomaron, and Tyne	3,062	18·5	6·89	8·51	8·5	7	9·35	15	168	—	10	157·5	173	Harton unscreened	Sept. to Nov.	
103	Tyne, Lisbon, Pomaron, and Tyne	3,084	17·25	7·44	9·68	11	8	10·78	10	169	25	18	167	186	Beckworth's unscreened / Welsh abroad	Nov. to Dec.	
104	Tyne, Tees, Pomaron, and Tyne	3,055	16·5	7·71	10·15	10	6·5	11·15	18	180	—	14	167·5	184	Adair's Main unscreen'd	1885-6. Dec. to Jan.	
105	Tyne, Pomaron, and Tyne	3,040	15·75	8·04	10·80	8	6·5	11·71	14	185·5	—	15	170	184·5	Adair's Main unscreen'd	Jan. to Feb.	
106	Tyne, Tees, Pomaron, and Tyne	3,055	16·25	7·83	10·03	10·5	6·5	11·07	15	180	—	15	163	180	Adair's Main unscreen'd	Feb. to Mar.	
107	Tyne, Tees, Pomaron, and Tyne	3,055	16·75	7·59	9·19	14	7	10·44	15	180	—	20	154	175	Adair's Main unscreen'd	Mar. to April	
108	Tyne, Tees, Pomaron, and Tyne	3,055	14·25	8·93	10·28	14·5	5	11·64	20	159	—	13	146·5	166	Adair's Main unscreen'd	April to May	
109	Tyne, Pomaron, and Tyne	3,040	15·25	8·3	9·34	18	7	10·98	13	169·5	—	15	142·5	167·5	Adair's Main unscreen'd	May to June	
110	Tyne, Oporto, Pomaron, and Tyne..	3,062	16·00	7·97	9·12	16	4	10·37	15	166	—	15	146	166	Adair's Main unscreen'd	June to July	
	Mean results, excluding Voyage 100	3,100	16·31	7·91	9·84	11·71	6·57	10·96	—	—	—	—	160·63	178·92			

* Voyage 100.—This voyage being different to the rest, it was considered advisable to exclude it in taking the mean results.

TABLE V.

S.S. *DANIA.*

NINE VOYAGES AFTER "FORCED DRAUGHTING."

Voyage Number.	Voyage.	Distance.	Days Steaming.	Knots per Hour.	Consumption per Day Steaming.	Donkey Steaming.	Raising Steam, Banked Fires, &c.	Consumption for all Purposes per Day Steaming.	Bunkers.						Name of Bunkers.	Date of Voyage.	Remarks.
									Left from last Voyage.	North Country.	Other sorts, including Abroad.	Left end of Voyage.	Total Consumption per Day Steaming.	Total Consumption for all Purposes per Voyage.			
111*	Tyne, Tees, Tyne, Tarragona, Carthagena, and Tees..	4306	26·33	6·81	7·44	17	19	8·80	15	184	35	2	196	232	Mixed nuts	1886. Aug. to Sept.	* Voyage 111.—This voyage being different to the rest, and experiencing some difficulty with the fan arrangement, it was considered advisable to exclude it in taking the mean results. It will be observed the whole of these voyages were made in the *winter* months.
112	Tees, Pomaron, and Tyne	3018	17·00	7·39	7·88	15	19	9·88	2	150	25	9	134	168	Norwood double-screened nuts Welsh abroad	Sept. to Nov.	
113	Tyne, Pomaron, and Tyne	3040	16·5	7·67	7·87	19	10	9·63	9	114	43	7	130	159	Adair's Main unscreened North Country abroad	Nov. to Dec.	
114	Tyne, Tees, Pomaron, and Tyne	3055	15·75	8·08	7·80	17	8	9·39	7	167	—	26	123	148	Adair's Main unscreened	1886-87. Dec. to Jan.	
115	Tyne, Pomaron, and Tyne	3040	17·75	7·13	7·63	18	8·5	9·12	26	155	—	19	135·5	162	Adair's Main unscreened	Jan. to Feb.	
116	Tyne, Pomaron..	—	Sunk	at	Po	maron	—	—	—	—	—	—	—	—			
117	Hartlepool, Tees, Pomaron, and Liverpool	2665	14·87	7·46	7·75	13	6·75	9·07	—	163	—	28	115·25	135	Auckland Park	1887. Sept. to Oct.	
118	Liverpool, Penarth, Gibraltar, Pomaron, and Liverpool	2736	16·64	6·85	7·27	18	17·25	9·39	28	158·35	—	30	121·10	156·35	Ynishir Standard Merthyr	Oct. to Nov.	
119	Liverpool, Newport, Lisbon, Pomaron, and Swansea	2421	13·41	7·52	7·65	15·6	6·2	9·28	30	138·5	—	44	102·70	124·5	Powell Duffryn	Nov. to Dec.	
120	Swansea, Cardiff, Cadiz, Pomaron, and Tyne ..	2748	15·20	7·53	7·43	20·75	4·6	9·10	44	118·4	—	24	113·05	138·4	Ynishir Standard Merthyr	1887-88. Dec. to Jan.	
	Mean results, excluding Voyage 111	2840	15·89	7·44	7·66	17·04	10·03	9·37	—	—	—	—	121·82	148·9			

TABLE VI.

S. S. *ETNA*

TEN VOYAGES PRIOR TO "TRIPLING."

Voyage Number.	Voyage.	Distance.	Days Steaming.	Knots per Hour.	Consumption per Day Steaming.	Donkey Steaming.	Raising Steam, Banked Fires, &c.	Consumption for all Purposes per Day Steaming.	Bunkers. Left from last Voyage.	Bunkers. North Country.	Bunkers. Other Sorts, including Abroad.	Bunkers. Left end of Voyage.	Total Consumption per Day Steaming.	Total Consumption for all Purposes per Voyage.	Name of Bunker.	Date of Voyage.	Remarks.
59	Tees, Tyne, Savona, Rio-Marino, and Tees ..	5069	26·333	8·02	12·07	2·5	14.5	12·72	22	346	—	33	318	335	Towneley unscreened	1885. May to July.	1886—Jan. to June, ship "Laid up."
60	Tees, Tyne, Carthagena, Porman, and Tees ..	3744	19·5	8·00	10·52	7	10	11·39	33	199·25	—	10	205·25	222·25	Hutton Henry steam	July to Aug.	
61	Tees, Naples, Carthagena, and Tees	5180	26·75	8·06	10·51	7	10	11·15	10	303·3	—	15	281·3	298·3	Byer's Green Best	Aug. to Sept.	
62	Tees, Tyne, Carthagena, and Tees	3732	20·125	7·72	11·52	10	15	12·77	15	247	20	25	232	257	Harton unscreened / Welsh abroad	Sept. to Nov.	
63	Tees, Tyne, Carthagena, Porman, and Tees ..	3744	21·166	7·37	10·72	10	16	11·95	25	231	—	3	227	253	Harton unscreened	Nov. to Dec.	
64	Tees, Tyne, Carthagena, and Tees	3732	21·0	7·40	11·37	10	15	12·56	3	255·85	20	15	238·85	263·85	Harton unscreened / Welsh abroad	1885-86. Dec. to Jan.	
65	Tees, Marseilles, Carthagena, and Tees	4585	23·5	8·12	10·00	9	17	11·11	15	291·2	—	45	235·2	261·2	Story Lodge and North Bitchburn Best screened	June to July.	
66	Tees, Tyne, Carthagena, and Tees	3732	18·708	8·31	10·00	10	12	11·17	45	214	—	50	187	209	Harton unscreened	July to Aug.	
67	Tees, Tyne, Valencia, Carthagena, and Tees.	4061	21·333	7·93	9·23	8	16	10·36	50	211	—	40	197	221	Walbottle unscreened	Aug. to Sept.	
68	Tees, Tyne, Carthagena, and Tees	3732	21·166	7·34	9·44	7·6	16	10·56	40	181·6	20	18	200	223·6	Walbottle unscreened / Welsh abroad	Sept. to Oct.	
	Mean Results	4131·1	21·958	7·83	10·57	8·11	14·15	11·58	—	—	—	—	232·16	254·42			

TABLE VII.

S. S. *ETNA*

THREE VOYAGES AFTER "TRIPLING" BEFORE APPLICATION OF "FORCED DRAUGHT."

69	Tees, Civita Vecchia, Carthagena, Porman & Tees	4980	26·25	7·9	7·96	18	12·15	9·11	—	209·15	55	25	209	239·15	Best Evenwood S.D. Nutts, and Tees Hetton Best / Welsh abroad	1887 Jan. to Feb.	
70	Tees, Tyne, Savona, Carthagena, Porman & Tees	4925	27	7·6	7·46	8·5	15	8·33	25	212	—	12	201·5	225	Springwell unscreened	Feb. to April	
71	Tees, Naples, Civita Vecchia, Carthagena & Tees	5225	29·916	7·27	6·76	15	12	7·66	12	220·4	15	18	202·4	229·4	Byers Green Best / Welsh abroad	April to May	
	Mean results.. ..	5043·3	27·722	7·58	7·36	13·83	13·05	8·33	—	—	—	—	204·30	231·18			

TABLE VIII.

S.S. *ETNA*.

SIX VOYAGES AFTER THE APPLICATION OF "FORCED DRAUGHT."

Voyage Number	Voyage.	Distance.	Days Steaming.	Knots per Hour.	Consumption per Day Steaming.	Donkey Steaming.	Raising Steam, Banked Fires, &c.	Consumption for all Purposes per Day Steaming	Bunkers. Left from last Voyage.	Bunkers. North Country.	Bunkers. Other Sorts, including Abroad.	Bunkers. Left end of Voyage.	Bunkers. Total Consumption per day Steaming.	Bunkers. Total Consumption for all Purposes per Voyage.	Name of Bunker.	Date of Voyage.	Remarks.
72	Tees, Tyne, Leghorn, Carthagena, Porman & Tees	4989	24·25	8·57	6·92	11	7	7·67	18	204	—	36	168	186	Allerdean unscreened	1887 May to June	
73	Tees, Tyne, Savona, Carthagena and Tees.. ..	4913	24·91	8·21	6·82	8	4	7·3	36	170	—	24	170	182	Walbottle Best	June to Aug.	
74	Tees, Tyne, Nice, Carthagena and Tees	4783	22·5	8·85	6 88	14	7·8	7·85	24	184·8	—	32	155	176·8	Walbottle Best	Aug. to Sept.	
75	Hartlepool, Blyth, Carthagena and Tees	3743	17·75	8·78	6·71	12	7·5	7·75	32	151·65	—	46	118·15	137·65	Hutton Henry	Sept. to Oct.	
76	Tees, Genoa, Carthagena and Tees..	5024	26·0	8·05	7·95	13·75	12·25	8·95	46	188·85	15	17	206.85	232·85	Norwood Best Steam / Welsh abroad	Oct. to Dec. 1887-88	
77	Tees, Tyne, Toulon, Carthagena, Gorgeul & Tees	4707	24·5	8·00	6·93	16·55	14	8·18	17	205·55	—	22	170	200·55	Walbottle Best	Dec. to Jan.	
	Mean Results	4693·16	23·32	8·38	7·06	12·55	8·76	7·97	—	—	—	—	164·66	185·97			

TABLE IX.

S.S. *MARMORA*.

SUMMARY OF RESULTS AS PER TABLES II. AND III.

Conditions.	Distance.	Days Steaming.	Knots per Hour.	Consumption per Day Steaming.	Donkey Steaming.	Raising Steam, Banked Fires, &c.	Consumption for all Purposes per Day Steaming.	Total Consumption per Voyage Steaming.	Total Consumption for all Purposes per Voyage.	Total Cost of Bunkers for all Purposes per Voyage.
Mean of 12 Voyages "Natural Draught"	3125·83	16·81	7·74	8·72	14·87	15·46	10·52	146·68	177·02	78 7 0
Mean of 11 Voyages "Forced Draught"	2998·6	16·69	7·48	8·49	12·72	8·91	9·79	141·83	163·46	44 19 8
Comparative Results	—	·12	— ·26	·23	2·15	6·55	·73	4·85	13·56	33 7 4

TABLE VI.

S. S. *ETNA*

TEN VOYAGES PRIOR TO "TRIPLING."

Voyage Number.	Voyage.	Distance.	Days Steaming.	Knots per Hour.	Consumption per Day Steaming.	Donkey Steaming.	Raising Steam, Banked Fires, &c.	Consumption for all Purposes per Day Steaming.	Bunkers. Left from last Voyage.	Bunkers. North Country.	Bunkers. Other Sorts, including Abroad.	Bunkers. Left end of Voyage.	Total Consumption per Day Steaming.	Total Consumption for all Purposes per Voyage.	Name of Bunker.	Date of Voyage.	Remarks.
59	Tees, Tyne, Savona, Rio-Marino, and Tees ..	5069	26·333	8·02	12·07	2·5	14.5	12·72	22	346	—	33	318	335	Towneley unscreened	1885. May to July.	1886—Jan. to June, ship "Laid up."
60	Tees, Tyne, Carthagena, Porman, and Tees ..	3744	19·5	8·00	10·52	7	10	11·39	33	199·25	—	10	205·25	222·25	Hutton Henry steam	July to Aug.	
61	Tees, Naples, Carthagena, and Tees	5180	26·75	8·06	10·51	7	10	11·15	10	303·3	—	15	281·3	298·3	Byer's Green Best	Aug. to Sept.	
62	Tees, Tyne, Carthagena, and Tees	3732	20·125	7·72	11·52	10	15	12·77	15	247	20	25	232	257	Harton unscreened / Welsh abroad	Sept. to Nov.	
63	Tees, Tyne, Carthagena, Porman, and Tees ..	3744	21·166	7·37	10·72	10	16	11·95	25	231	—	3	227	253	Harton unscreened	Nov. to Dec.	
64	Tees, Tyne, Carthagena, and Tees	3732	21·0	7·40	11·37	10	15	12·56	3	255·85	20	15	238·85	263·85	Harton unscreened / Welsh abroad	1885-86. Dec. to Jan.	
65	Tees, Marseilles, Carthagena, and Tees	4585	23·5	8·12	10·00	9	17	11·11	15	291·2	—	45	235·2	261·2	Story Lodge and North Bitchburn Best screened	June to July.	
66	Tees, Tyne, Carthagena, and Tees	3732	18·708	8·31	10·00	10	12	11·17	45	214	—	50	187	209	Harton unscreened	July to Aug.	
67	Tees, Tyne, Valencia, Carthagena, and Tees.	4061	21·333	7·93	9·23	8	16	10·36	50	211	—	40	197	221	Walbottle unscreened	Aug. to Sept.	
68	Tees, Tyne, Carthagena, and Tees	3732	21·166	7·34	9·44	7·6	16	10·56	40	181·6	20	18	200	223·6	Walbottle unscreened / Welsh abroad	Sept. to Oct.	
	Mean Results	4131·1	21·958	7·83	10·57	8·11	14·15	11·58	—	—	—	—	232·16	254·42			

TABLE VII.

S.S. *ETNA*

THREE VOYAGES AFTER "TRIPLING" BEFORE APPLICATION OF "FORCED DRAUGHT."

69	Tees, Civita Vecchia, Carthagena, Porman & Tees	4980	26·25	7·9	7·96	18	12·15	9·11	—	209·15	55	25	209	239·15	Best Evenwood S.D. Nutts, and Tees Hetton Best / Welsh abroad	1887 Jan. to Feb.	
70	Tees, Tyne, Savona, Carthagena, Porman & Tees	4925	27	7·6	7·46	8·5	15	8·33	25	212	—	12	201·5	225	Springwell unscreened	Feb. to April	
71	Tees, Naples, Civita Vecchia, Carthagena & Tees	5225	29·916	7·27	6·76	15	12	7·66	12	220·4	15	18	202·4	229·4	Byers Green Best / Welsh abroad	April to May	
	Mean results.. ..	5043·3	27·722	7·58	7·36	13·83	13·05	8·33	—	—	—	—	204·30	231·18			

TABLE VIII.

S.S. *ETNA*.

Six Voyages after the Application of "Forced Draught."

Voyage Number	Voyage.	Distance.	Days Steaming.	Knots per Hour.	Consumption per Day Steaming.	Donkey Steaming.	Raising Steam, Banked Fires, &c.	Consumption for all Purposes per Day Steaming	Bunkers. Left from last Voyage.	Bunkers. North Country.	Bunkers. Other Sorts, including Abroad.	Bunkers. Left end of Voyage.	Bunkers. Total Consumption per day Steaming.	Bunkers. Total Consumption for all Purposes per Voyage.	Name of Bunker.	Date of Voyage.	Remarks.
72	Tees, Tyne, Leghorn, Carthagena, Porman & Tees	4989	24·25	8·57	6·92	11	7	7·67	18	204	—	36	168	186	Allerdean unscreened	1887 May to June	
73	Tees, Tyne, Savona, Carthagena and Tees.. ..	4913	24·91	8·21	6·82	8	4	7·3	36	170	—	24	170	182	Walbottle Best	June to Aug.	
74	Tees, Tyne, Nice, Carthagena and Tees	4783	22·5	8·85	6 88	14	7·8	7·85	24	184·8	—	32	155	176·8	Walbottle Best	Aug. to Sept.	
75	Hartlepool, Blyth, Carthagena and Tees	3743	17·75	8·78	6·71	12	7·5	7·75	32	151·65	—	46	118·15	137·65	Hutton Henry	Sept. to Oct.	
76	Tees, Genoa, Carthagena and Tees..	5024	26·0	8·05	7·95	13·75	12·25	8·95	46	188·85	15	17	206.85	232·85	Norwood Best Steam / Welsh abroad	Oct. to Dec. 1887-88	
77	Tees, Tyne, Toulon, Carthagena, Gorgeul & Tees	4707	24·5	8·00	6·93	16·55	14	8·18	17	205·55	—	22	170	200·55	Walbottle Best	Dec. to Jan.	
	Mean Results	4693·16	23·32	8·38	7·06	12·55	8·76	7·97	—	—	—	—	164·66	185·97			

TABLE IX.

S.S. *MARMORA*.

Summary of Results as per Tables II. and III.

Conditions.	Distance.	Days Steaming.	Knots per Hour.	Consumption per Day Steaming.	Donkey Steaming.	Raising Steam, Banked Fires, &c.	Consumption for all Purposes per Day Steaming.	Total Consumption per Voyage Steaming.	Total Consumption for all Purposes per Voyage.	Total Cost of Bunkers for all Purposes per Voyage.
Mean of 12 Voyages "Natural Draught"	3125·83	16·81	7·74	8·72	14·87	15·46	10·52	146·68	177·02	78 7 0
Mean of 11 Voyages "Forced Draught"	2998·6	16·69	7·48	8·49	12·72	8·91	9·79	141·83	163·46	44 19 8
Comparative Results	—	·12	— ·26	·23	2·15	6·55	·73	4·85	13·56	33 7 4

TABLE X.

S. S. *DANIA.*

SUMMARY OF RESULTS AS PER TABLES IV. AND V.

Conditions.	Distances.	Days Steaming.	Knots per Hour.	Consumption per Day Steaming.	Donkey Steaming.	Raising Steam, Banked Fires, &c.	Consumption for all Purposes per Day Steaming.	Total Consumption per Voyage Steaming.	Total Consumption for all Purposes per Voyage.
Mean of 13 Voyages "Natural Draught"	3100	15·31	7·91	9·84	11·71	6·57	10·96	160·63	178·92
Mean of 8 Voyages "Forced Draught"	2840	15·89	7·44	7·66	17·04	10·03	9·37	121·82	148·90
Comparative Results	—	·42	— ·47	2·18	— 5·33	— 3·46	1·59	38·81	30·02

TABLE XI.

S. S. *ETNA.*

SUMMARY OF RESULTS AS PER TABLES VI. AND VII.

Mean of 10 Voyages prior to "Tripling"	4131·1	21·958	7·83	10·57	8·11	14·15	11·58	232·16	254·42
Mean of 3 Voyages "Tripled"	5043·3	27·722	7·58	7·	13·83	13·05	8·33	204·30	231·18
Comparative Results	—	— 5·764	— ·25	3·21	— 5·72	1·10	3·25	27·86	23·24

TABLE XII.

S. S. *ETNA.*

SUMMARY OF RESULTS AS PER TABLES VII AND VIII.

Mean of 3 Voyages "Tripled"	5043·3	27·722	7·58	7·36	13·83	13·05	8·33	204·30	231·18
Mean of 6 Voyages "Tripled and Forced Draught" ..	4693·16	23·32	8·38	7·06	12·55	8·76	7·97	164·66	185·97
Comparative Results	—	4·402	+ ·80	·30	1·28	4·29	·36	39·64	45·21

BOILERS UNDER FORCED DRAUGHT ON THE CLOSED STOKEHOLD SYSTEM.*

By Thomas Soper, Esq., R.N., Member.

In 1883 a paper was read by Mr. Butler, of the Admiralty, in which the introduction of forced draught into vessels for H.M. Navy was, so far as I am aware, first brought to the notice of members of this Institution. The two ships described were the *Satellite* and *Conqueror*. A full account of the method of fitting the system was given, together with the results of the trials which had been made in 1882, and in the early part of 1883, but no experience had been obtained with either of the vessels as to what was likely to occur when on actual service at sea.

At that time it was apprehended in some quarters that, although the closed stokehold system had the great advantage of considerably increasing the evaporative power of the boilers, experience would prove that their durability would be diminished. The system has now had a trial lasting over some years, and it is found that the boilers of vessels fitted with the forced draught are in quite as good condition as those which are worked with natural ventilation only.

Since that date, practically all the vessels which have been built for the Navy have been fitted with the forced draught on the closed stokehold system, and many of them have served one or more commissions at sea, the boilers being subject to the same conditions as is usual in the case of war-vessels. Of the two vessels, the *Satellite* and *Conqueror*, the latter has not been in commission, but has only been employed temporarily in the Steam Reserve, and in the manœuvres of last year. The *Satellite* was, however, commissioned in the early part of 1883, for service on the Pacific station, and in 1886 was re-commissioned for a further term of three years. The sister vessels, supplied with machinery and boilers by the same firm, but fitted with natural ventilation only, have been similarly employed. The vessels are engaged on the ordinary service to which war-vessels are subject, and the boilers have had practically the same amount of work. The boilers have been carefully examined and drilled, and water tested at the usual intervals: and, as far as can be seen, the boilers of the *Satellite* are now in quite as good condition as those of the other vessels of the class. The original steam pressure has been maintained, and the boilers are reported as being good for many years' further service.

The twin-screw torpedo ram *Polyphemus*, of 2,640 tons displacement, was fitted with her present boilers in 1884. There are eight low circular boilers of the ordinary Navy type, each with two furnaces 3 ft. 4 in. in diameter, with a length of grate of 6 ft. 9 in. On her official trial the engines developed 5,520 I.H.P. The stokeholds are closed, air being supplied by four fans; no provision is made for natural ventilation, and when at sea the boilers are generally under air pressure. This vessel has not only been engaged on the ordinary naval service since 1884, but for several months was employed in making experiments with torpedo tubes, when the boilers were subject to most unequal working. The *Polyphemus* was recommissioned in October, 1887, when her boilers were reported to be in a most satisfactory condition, and fully capable of maintaining the original steam pressure of 110 lbs. Owing to the use of the boilers for distilling purposes, and consequently scale being deposited on the heating surfaces, a few tubes leaked occasionally during the earlier part of her commission, and in March, 1887, it was decided to fit double distillers. Since these have been fitted, and the boilers supplied with fresh water, the tubes have kept quite tight, and no difficulty of any kind has been experienced with the boilers.

Torpedo boats are, as is well known, fitted with closed stokeholds, and it is very satisfactory to know that when the simultaneous full-speed steaming down the Channel in May of last year took place, there were only two cases in which the boilers gave trouble, being those of the two boats in which the crowns of the fireboxes came down through shortness of water—clearly not attributable to the use of the forced draught.

Those who are acquainted with the method of conducting Admiralty trials know that the boilers are more severely tested during the official forced draught trials, which are usual when machinery is received from the contractors, than is likely to be experienced afterwards. Yet the experience of the receiving officers at the dockyards proves that the condition of the boilers after such a trial is, as a rule, much better than in the old days when the steam blast was used.

The total number of ships whose forced draught trials have been completed, since the introduction of the system, is 50, representing a total I.H.P. of 254,000. Of these the only cases in which any difficulty with the boilers was experienced was in three of the vessels of the *Archer* class, when the boiler tubes leaked. On examination it was found that this was not due to the use of the forced draught, but to purely local causes. This was remedied, and the trials satisfactorily completed. Recently the *Porpoise*, one of the vessels of the class, has made a continuous trial of ninety-six hours' duration at the full sea-going power, with most satisfactory results. The boilers were, during the whole of the trial, worked with a moderate air pressure, and, so far as their condition was concerned, the trial could have been lengthened to any desired extent.

The closed stokehold system lends itself admirably to the necessities of vessels in actual warfare, for it is necessary that the openings down to the engine and boiler rooms should be kept as small as possible, and in all cases the machinery department would be closed down, and the air supplied by artificial means, and with any system but that of the closed stokehold, to have the same advantages as to protection, it would be necessary to provide two sets of fans, one for the fires and the second for ventilation of the boiler rooms. Taking the case of the two cruisers, the *Amphion* and *Orlando*, the latter being fitted with closed stokeholds, while the former has natural ventilation only, the area of opening for the admission of air to the boiler rooms is in the *Amphion* 207 sq. ft., while in the *Orlando* it is only 103 sq. ft., although on the official trials the *Orlando's* machinery developed 8,700 I.H.P. to 5,600 only in the *Amphion*. With the stokeholds closed and under air pressure it is easy to provide by sliding shutters in suitable places for the complete ventilation of the whole of the spaces round the boilers, such as the smoke-box compartments, which, owing to the high temperature of the fires and gases in the uptakes, are liable to become hot. The men also experience but little, if any, inconvenience when in the boiler rooms, for although the apparent temperature is high, owing to the ash-pit dampers being off, the air is constantly changed, so that the actual temperature is not excessive.

As to the effect on the heating surfaces of the boilers when working with forced draught, it is immaterial whether the stokehold is closed or any other system of forced draught is used; the temperature of the fires is the same, supposing the boilers to be doing the same amount of work, and so long as the heating surfaces are clean, no harm will ensue; but if they are allowed to become coated with scale or dirt, the result will be the same in the two cases. The boilers of war-vessels, when the main engines are not at work, are constantly in use for distilling purposes, and, with the old distillers of the single type, in which the salt was deposited in the distilling boiler, it was impossible to keep the boilers clean, but with the double distillers which have been recently introduced, in which the steam, after heating the water in the evaporator, is returned to the boilers, no difficulty will be experienced in keeping the boilers in such a condition that they may be used at any time with the forced draught.

In the above remarks attention has not been directed to any special type of boiler, but as the *Rattlesnake* is the only vessel in the Navy which has been worked continuously with more than one boiler of the locomotive type, it will be interesting to learn the effects of forced draught on this special type of boiler. The *Rattlesnake* was built and engined by Messrs. Laird, and is fitted with two sets of triple-expansion vertical engines, the diameters of the cylinders being 18½, 27, and 42 in. respectively, with a stroke of 18 in. The boilers, four in number—diameter of barrel 5 ft. 10 in., length 16 ft. 6 in.—are of the locomotive type, but with wet bottoms to the fire-boxes. In the fire-box running fore and aft are three water tubes, flat-shaped, 13½ in. by 3 in. at the bottom, and increasing to 20½ in. by 4¼ in. at the top. The total grate area of the four boilers is 126 sq. ft., with a tube surface of 4,085 sq. ft., the length of the tubes being 7 ft. 9½ in. between the tube-plates, and diameter 1¾ in. The official trial, which lasted three hours, was made in February, 1887, when the following results were obtained:—

Mean I.H.P. for the three hours	2,740
Maximum I.H.P.	2,802
Mean number of revolutions of engines	309
Speed of vessel	19·5 knots
Mean air pressure in boiler rooms	2·39 in. of water
Maximum ,, ,, ,, ...	2·5 ,,
Average steam pressure in boilers..	135 lbs.

* *Read at the Twenty-ninth Session of the Institution of Naval Architects, March 22nd, 1888.*

The boilers were found after the trial to be in a very satisfactory condition, and the vessel was placed in commission with a view to testing the efficiency of the machinery and boilers in actual service at sea. Since then the vessel has been constantly employed, and in the manœuvres of last year in the Channel took an active part, when she was worked at various speeds, not gradually, but from full to slow speed and *vice versâ* suddenly, and on no occasion did the boilers give any trouble. It must not be forgotten that the boilers of war-vessels are subject to most unequal working, and the strains brought on them are of necessity in excess of those on the boilers of vessels employed on ordinary mercantile service. At first, in the *Rattlesnake*, some difficulty was experienced with the fire-bars, which were found to burn, and require partial renewal after the boilers had been run at full power for some hours. This was remedied by fitting water-pans in the ash-pits, as is usual in torpedo boats' boilers, and since then no difficulty has been experienced. In all later vessels provision has been made for letting water into pans fitted in the ash-pits when the vessels are under forced draught.

The official trials for maximum power under forced draught are usually of four hours' duration, so that no reliable results have been ascertained as to the actual consumption of coal. The trials are to ascertain the maximum power that can be developed by the engines and boilers, and the duration of trial being short, particular attention is not paid to the coal consumption. When working at the maximum power with the forced draught, neither the engines nor boilers are worked under their most economical conditions, the object being to get as much power as possible out of the machinery, so that in the case of an emergency the vessel may be driven for a time at her uttermost speed. At lower powers, however, with a moderate air pressure, the boilers work economically, the supply of air is uniform, being regulated by the speed of the fans, so that the economy will be greater than when trusting entirely to the funnel draught. In the case of vessels on war service, it is necessary to continually alter the speed, but this is found to have no injurious effect on the boilers. Provision is made by fitting a pipe with a valve in it to admit the steam direct to the condensers, and so prevent its blowing off on deck, and it is never necessary suddenly to alter the condition of the boiler rooms, the speed of the fans being varied gradually to suit the altered circumstances.

The belted cruisers are the largest vessels in the Navy which, up to the present, have been tried with triple-expansion engines, and six of these have within the past year completed their official trials. These six vessels were engined by three firms—Messrs. Napier, Palmer's Company, and Earle's Company. The engines are horizontal, and, excepting details of construction, are practically the same in the different vessels. There are four double-ended boilers to each vessel, and there is only one point of difference in their construction to which I would call attention. Each boiler is fitted with six furnaces, three at each end; in the *Orlando* and *Undaunted*, by Palmer's Company, and the *Narcissus* and *Immortalité*, by Earle's Company, there is one combustion chamber to each opposite pair of furnaces—that is, three combustion chambers, with waterways running fore and aft the boilers between them. In the *Australia* and *Galatea*, by Messrs. Napier, there is one combustion chamber only to the six furnaces. The results obtained by the single combustion chamber boiler are superior to the others, as will be seen from the following table:—

	Orlando.	Undaunted.	Australia.	Galatea.	Narcissus.	Immortalité.
Makers of engines	Palmer's Company, Jarrow	Palmer's Company, Jarrow	R. Napier & Sons, Glasgow	R. Napier & Sons, Glasgow	Earle's Company, Hull	Earle's Company, Hull
Diameter of boiler (external)..	14ft. 10½in.	14ft. 10½in.	14ft. 8½in.	14ft. 8½in.	14ft. 8½in.	14ft. 8½in.
Length of boiler	16ft. in.	16ft. 6in.	16ft. 9in.	16ft. 9in.	17ft. 6in.	16ft. 6in.
Fire-grate area, in square feet (total) ..	540	540	500	500	534	488
Tube surface, in square feet (total) ..	13,845	13,845	13,480	13,480	13,340	13,152
Mean I.H.P. during the four hours' trial	8,739	8,670	8,876	9,219	8,589	8,737
Maximum I.H.P. for one half-hour ..	9,120	9,092	9,130	9,653	8,827	9,362
Steam pressure in boiler (mean)	129	126	132	138	131	126
Air pressure in stokeholds (mean) ..	1·05	1·87	1·75	1·15	2·03	2
I.H.P. per square foot of grate (mean).	16·18	16·05	17·75	18·44	16·08	17·90
,, ,, ,, (maximum)	16·88	16·83	18·26	19·30	16·53	19·18

Considerably more power could have been obtained from the *Galatea* had the engines been large enough to take the steam, for during the greater portion of the time steam was blowing off at the safety-valves. I must not omit to mention that in the latter vessel feed water heaters were fitted and the feed pumps were automatically worked, to which, probably, a portion of the satisfactory results may be accredited; still, I think the results show the superiority of the single combustion chamber, which has also the further advantage of reduced weight, and probably increased durability.

Messrs J. F. Waddington & Co.—We have been notified that this firm have just secured a contract for a steamer to run in Turkish waters. The dimensions will be 125 ft. overall, 120 ft. b.p., breadth (moulded) 20 ft., depth 9 ft.; to carry 150 tons on 7 ft. draught at a speed of 10 miles. The vessel will be flush decked fore and aft with high bulwarks and full poop for the accommodation of saloon passengers. The engines, by the same firm, will be compound surface condensing with cylinders 13 in., and 26 in., by 18 in., stroke, with steel boiler to work at 100 lbs. pressure.

Engines Contract.—The contract for the engines of the torpedo depôt ship has been awarded to Messrs. Humphrys, Tennant, and Co., of Deptford. The engines are to indicate 12,000 H.P., with which it is expected a speed of 20 knots will be attained.

The next meeting of the Institution of Mechanical Engineers takes place in London on the 3rd and 4th of May. The annual dinner will be on Friday, the 4th. The report on Friction of a Collar Bearing will be read, and a description of the Emery Testing Machine by Mr. H. R. Towne. A supplementary paper on "Petroleum Refuse as Fuel for Locomotives" will be read by Mr. T. Urquhart.

Torpedo Cruiser.—The *Fearless*, torpedo cruiser, has returned to Portsmouth after three ineffectual attempts to complete a 96 hours' continuous full-power run of her engines, previous to being commissioned for the Mediterranean. The first two attempts were frustrated by stormy weather, and the last was brought to a premature end by the excessive leaking of her boiler tubes.

THE "WADDINGTON" ELECTRICAL SUBMARINE VESSEL.

SUBMARINE navigation continues to receive attention from many foreign Governments, our own, however, standing aloof, despite the fact that in three cases differently designed and arranged craft, more or less suitable for submarine warfare, have been constructed in this country. The "Waddington" Electrical Submarine Vessel, to which we would now call particular attention, we consider, with all due deference to the ideas of other inventors and experts, to have manifest advantages over other existing or proposed submarine craft, more especially in *its limited dimensions* and necessarily *minimum* weight.

The writer considers that for "diving boats," or submarine craft for war purposes, to be utilized to their fullest extent, they must be of such a "handy" nature as to be easily accommodated on board all sea-going war-vessels, and as readily lowered into the water or raised out of it as an ordinary steam launch or large open boat. If a few of such submarine vessels were carried on every war-ship, it can be readily understood how frequently they might be used in placing mines under the enemy's vessels, by being able to approach them unseen. It is well known that the action of torpedoes is very uncertain, and it therefore becomes important to seek for some other more reliable method of destroying an opposing fleet. Suppose, for instance, a conflict is raging between two equally powerfully equipped vessels, with the exception that one of them carries submarine vessels, capable of depositing a quantity of the most efficient explosives at a given spot. One of these vessels is lowered into the water on the side of the vessel of which the enemy does not command a view, is immediately submerged, and proceeds on its errand. Having succeeded in its object, by means of an electrical communication, as soon as at a safe distance, the mine would be exploded. Now if larger craft than the "Waddington" were employed, failure in the undertaking would be much more probable, owing to the increased difficulty of launching the craft; and any accident to it would lead to a greater loss of life, owing to the increased number of the crew. Other considerations will also suggest themselves as militating against the successful employment of large submarine vessels in ordinary naval warfare.

It is, therefore, with considerable pleasure that we illustrate and describe the "Waddington" Electrical Submarine Vessel, designed by Mr. J. F. Waddington, of the firm of Messrs. J. F. Waddington & Co., shipbuilders and engineers, Seacombe, near Liverpool, which has recently undergone trials before the representatives of several European Governments, Count Candiani, of the Italian Navy, and other gentlemen, accompanying Mr. J. F. Waddington below water on various occasions.

Our illustrations, together with the following description, will give our readers a good idea of the construction and equipment of the vessel in its various details. Fig. 1 is a longitudinal section, and Fig. 2 a sectional plan. The principal dimensions are: length over all 37 ft., and diameter amidships 6 ft.; and, as will be seen from the drawings we reproduce, the hull of the vessel gradually tapers in a curve towards the stem and stern. Two bulkheads, B B, divide the vessel into three compartments, of which the two smaller end ones, C C, are utilized for the storage of the supply of the compressed air. The large compartment amidships is occupied by the electric motors and accumulators, pumping and steering apparatus, seats for the crew, &c. At the centre of the vessel, and at the upper portion of the hull, is the conning tower, A, provided with several circular side-lights, as well as with an oval-shaped scuttle, Q, on top, for entering the interior, provided with a watertight door secured from the inside.

The motive power, as already indicated, is electricity, and the arrangements for utilizing it consist of forty-five large accumulator cells, D, which have a capacity of 660 ampère hours each. They are coupled up in series to an electro motor, E, which drives the propeller, F, direct at about 750 revolutions per minute. The motor, when working at full speed, uses a current of about 66 ampères and 90 volts, developing 7·96 electrical H.P., which would drive the vessel for ten hours at a rate of eight miles an hour, thereby enabling the vessel to go eighty miles at full speed without replenishing the accumulators, while at half-speed the vessel would travel a distance of 110 miles, or at a slow speed for a distance of about 150 miles.

Amongst the considerable advantages claimed—and we believe with reason—for the adoption of electricity as the motive power are the following:—

First. There is no attention called to the vessel by the smoke and waste steam accompanying the getting up steam in submarine vessels using the ordinary motive power. When once the accumulators are charged, the Waddington vessel is ready to proceed at a moment's notice.

Second. Electricity is more economical, as, for instance, when stopped, the motive power is not subject to waste, as in the case of steam power.

Third. There is no consumption of air in promoting combustion in boiler furnaces, and no heat or poisonous gases are given off to pollute the air in the vessel—a very important characteristic for a submarine vessel.

Fourthly. As already pointed out in our introductory remarks, the small size of this vessel, due to the adoption of electrical power, allows of such craft being carried on a war-vessel's davits, ready for use, the same as any ordinary steam launch, &c.

There are yet several features in the "Waddington" vessel deserving of attention. Allusion has already been made to the small crew required. This is owing to the arrangements of the various *minutiæ* by which the vessel's movements are controlled. All the reversing switches, steering gear, levers, &c., are placed amidships, so that the captain, as we may fairly style the man in charge, while looking out of the conning tower, has all the levers within reach, so that the whole working of the vessel is under his sole and immediate control. A second man accompanies the captain or steersman, to assist should any emergency require it, so that at the most the crew consists of only two men.

Another feature is that on either side of the vessel large water-ballast tanks, G, are fitted, by filling which the buoyancy of the vessel may be reduced by several hundredweights, when preparing for submersion.

At the after end are arranged two vertical rudders, H H, and two horizontal ones, I I, the latter ones being used for maintaining the vessel on an "even keel" when it is being propelled under water. With considerable forethought, the rudders, I I, have been made to act automatically, as it is within the bounds of possibility that the man in charge might lose his presence of mind, in a moment of emergency. Every care has been taken to

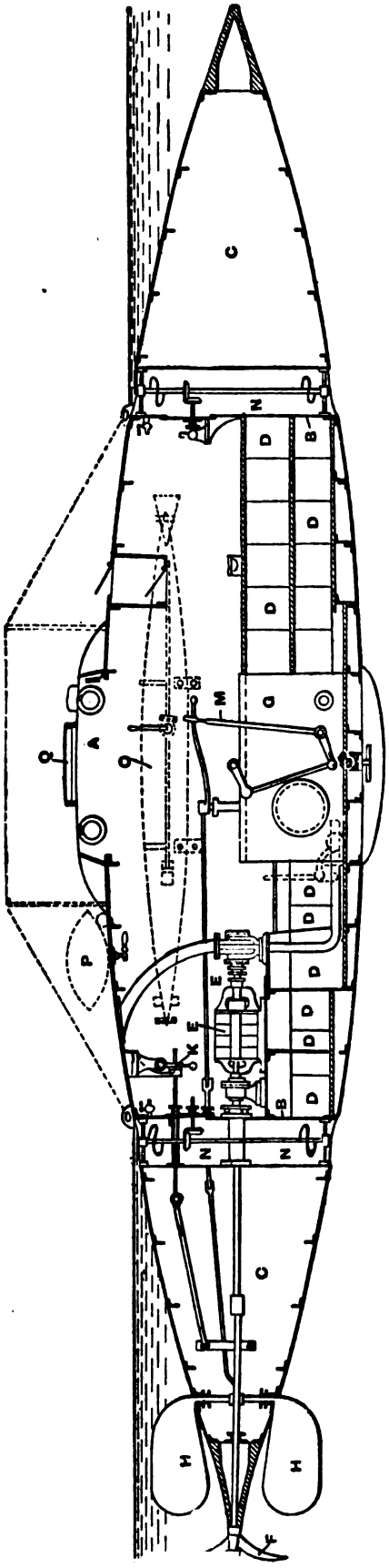


Fig. 1.

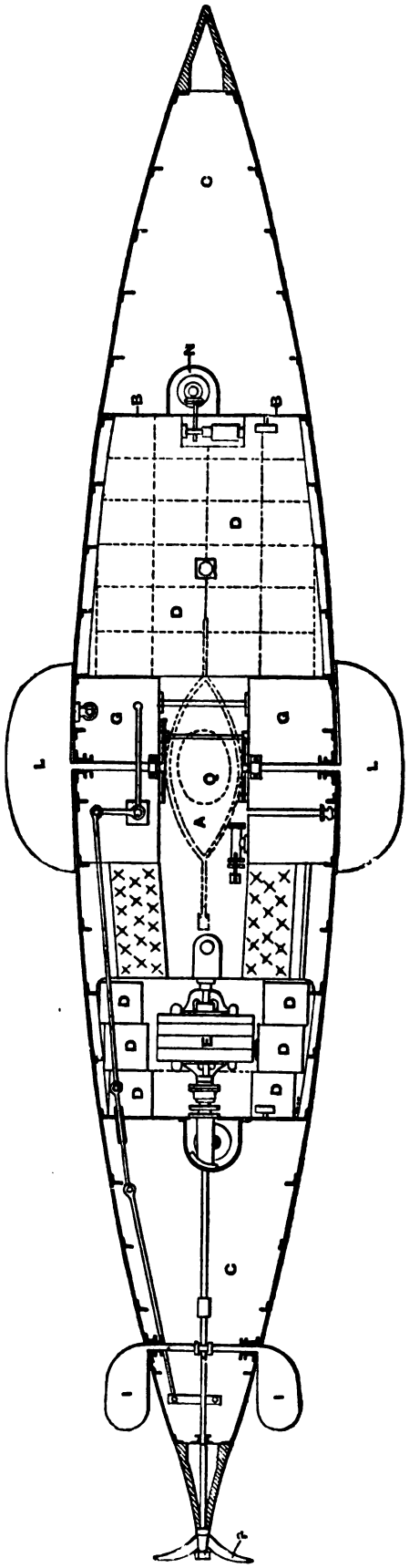


Fig. 2.

ELECTRICAL SUBMARINE VESSEL.

perfect the details of this "Waddington" Submarine Vessel, and, as an example, this automatic working of the horizontal rudders may be instanced. Originally, a pendulum was provided suspended from the top of the vessel and connected to the rudders, I I; but it did not answer with sufficient readiness to the movement of the craft, so that Mr. Waddington was led to adopt another *modus operandi*. In the latter arrangement he provides an electro-motor, K, which works into worm gearing, and is arranged in such a manner that the slightest cant up or down causes the rudder to be put over to meet it, and then stop in the same manner as a steam-steering gear.

The side planes, L L, are also noteworthy—they are balanced, and can readily be inclined to different angles by means of the lever, M, and are utilized in causing a diving action, when the vessel is progressing in a fore and aft direction. Reliance is not, however, placed upon the side planes for the work of submerging or emerging the vessel—indeed, for the latter purpose there are special precautionary arrangements. However, in ordinary practice the *modus operandi* of making the descent into the water is by means of the vertical propellors, N N. Close to the bulkheads at each end of the compartments, C C, a vertical tube, open at each end, extends right through the vessel, so as to leave a clear course for the water from the vertical propellors, N N, which are worked by separate motors, and may be used separately or together, as the occasion may require, for raising or lowering the vessels.

In case of a sudden leak, or other emergency, a heavy weight, attached at the bottom of the vessel in such a manner that it can be released from the inside of the vessel, affords an additional means of raising the vessel to the surface.

A brief reference must be made to the offensive equipment of the "Waddington." Two locomotive torpedoes, O, shown in dotted lines in Fig. 1, one on each side, are secured by grips, which can be cast adrift from the inside of the vessel. At the same time as the grips are released, and by the same action, the propelling motor of the torpedo is started, and it shoots ahead of the vessel. A mine torpedo, P, also shown in Fig. 1, is also carried for the purpose of attacking any vessel at anchor with its torpedo nettings in position. Attached to the mine is an electric wire, which can be readily payed out of the vessel, and by means of which the mine can be fired from a distance.

The portable guard rail and stanchions, which are provided for shipment when the vessel is acting as a surface boat, must not be overlooked. They are shown in dotted lines in the longitudinal sectional view, and form a very necessary provision for the vessel when in a seaway.

In closing our notice of this novel, interesting, and successful craft, it may be as well to briefly indicate the mode of working it which appears to be most advisable. In the first instance the water tanks, G G, are filled, immersing the hull so that only the conning tower is above water. There is then only several hundredweights of buoyancy remaining. The motor is then started, and a speed of, say, four to five miles an hour attained. The side planes, L, are inclined by means of the lever, M, and the vessel thereby submerged. By regulating the angle of the side planes and the speed, any reasonable depth may be maintained. If it be desirable to submerge the vessel without forward motion, only the vertical propellers are used, and any reasonable depth may be ensured by regulating their speed. These vertical propellers may also be used for regulating the depth when the vessel is moving onwards, but the use of the side planes is considered to be preferable by the inventor in that case. The fresh air is drawn from the two end compartments, C C, and the bad air escapes through a valve as soon as the pressure inside becomes greater than outside. The compressed air need, however, only be used when a stay of a lengthened period is to be made below the surface, as the centre compartment contains air sufficient for two men for six hours without drawing upon the supply of the compressed air.

It is to be hoped that the enterprise shown by Messrs. J. F. Waddington & Co., Seacombe, near Liverpool, will meet with its due reward. It is three years since Mr. J. F. Waddington turned his attention to the question of submarine vessels; and not only has he to be congratulated upon being foremost in seeking to utilize electricity in this special class of vessel, but also in producing the first electrically propelled vessel. Finality is, however, unknown in engineering in any branch, and in the special department of submarine propulsion much will be yet achieved, even in the early future, as at the present time Messrs. Waddington & Co. are designing a somewhat larger and more powerful vessel, to be driven by compressed air, in which a fuller development of the principles followed in the vessel above described will be witnessed. In common with many of our readers, we will await the building of the new "Waddington" with interest.

FIVE-INCH GEOMETRIC LATHE.

THE front slide lathe constructed by the London Lathe and Tool Company, 37, Pomeroy Street, London, S.E., shown in the two figures annexed, is so much of a novelty as to merit a notice in these pages. The two features which are most apparent in the engravings are the mode of driving and the construction of the slide rest. The usual driving cranks are dispensed with, and eccentric sheaves substituted, the object being to obtain a longer or shorter throw, varying with the heavy or light character of the work on hand. To produce this variation, the spindle of the lower sheave swivels loosely in its bearings in the treadle frame, so that it can be turned through the whole or any portion of a circle to alter its position relatively to the one above. The alteration can be effected instantly on the disengagement of the pitch chain; but when the chain is placed and strained on its sprockets the relative positions of the wheels cannot change during driving, because the interlocking of the sprockets and the links effectually prevents slip.

The motion of the driving wheel can be communicated to the work either with or without the intervention of the back gear; but, since the lathe is designed for geometrical work as well as for ordinary turning, the front cog-wheel, that is the one which receives motion from the back gear, is made to do duty as a division plate also. Evidently the presence of the ordinary locking bolt and slot, by means of which the cone pully and front wheel are commonly united, would interfere with the circles of holes for the division peg. Instead, therefore, of using the common bolt, the cone and wheel are clamped together

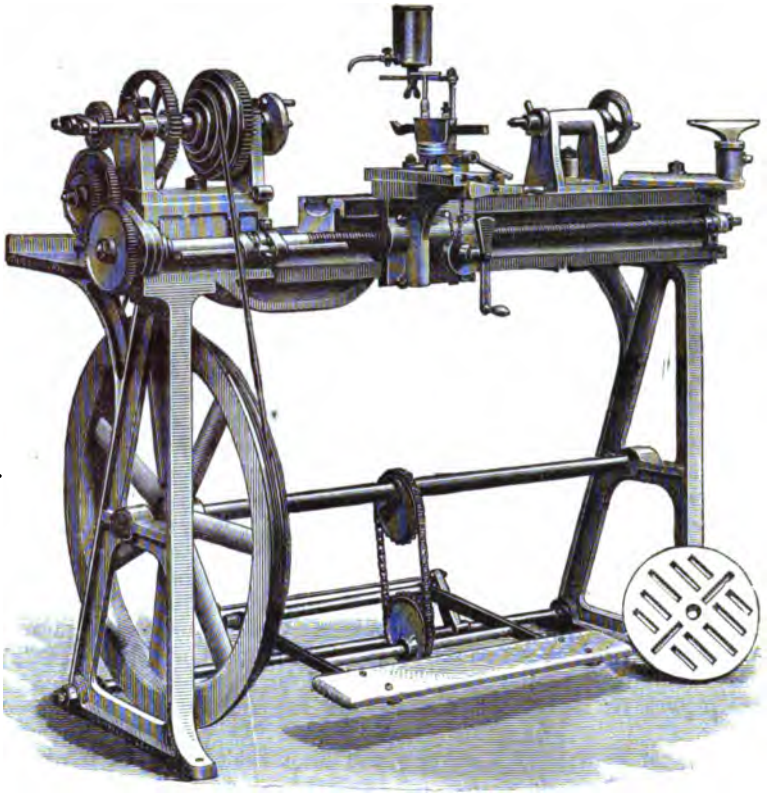


Fig 1.
FIVE-INCH GEOMETRIC LATHE.

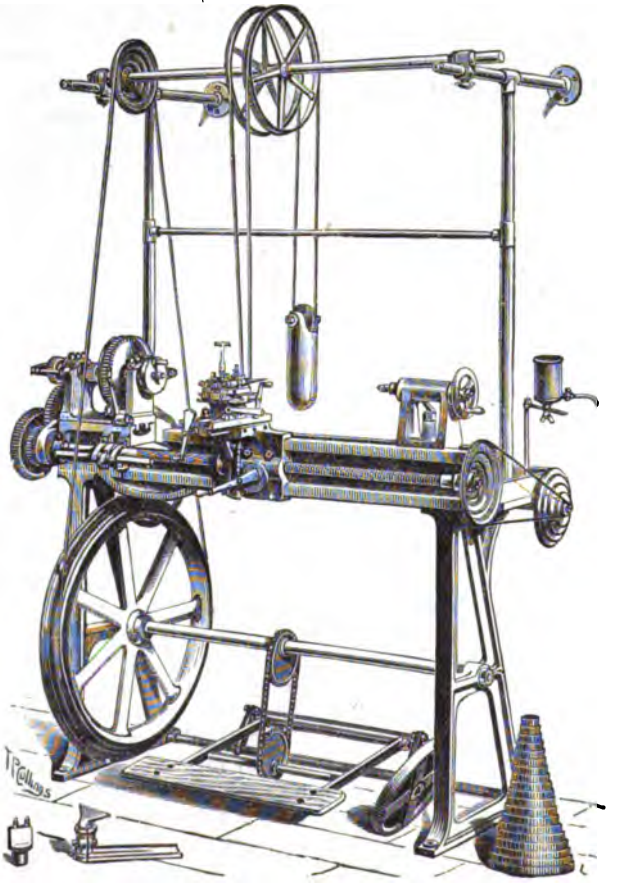


Fig. 2.

for heavy work by means of a nut encircling the mandrel at back of cone, which nut can be instantly tightened or slackened with a tommy. There are five circles of holes on the wheel face, numbering respectively 192, 180, 160, 120, and 100.

Communication between the headstock and saddle is made in two ways, either directly through the change wheels, or by means of a shaft which runs underneath the tool board at the back. The first is used for screw-cutting and heavy turning, the second for light turning only. In the first place a small four-jawed clutch at the left of the gap is placed in gear with a similar clutch on the left end of the leading screw, effecting a steady union between that end and the continuation of the same shaft just below the front of the headstock. In the second case, this clutch being thrown out of gear, the change wheels are inoperative, but the back-shaft drives in the way to be described directly. The action of the clutch is controlled by the small rod to be seen in the figures. This rod slides in lugs standing out in front of the bed, and is itself embraced by the boss of a fork, the boss having a set-screw for pinching it in any position on the rod, and the fork embracing the body of the sliding clutch. When the clutch is in gear, the leading screw to the right, and its prolongation to the left, are driven together; when out of gear, the leading screw is either not driven at all, or is driven by means of the back-shaft. The latter is operated by a cord running over a single-speed pully at the tail end of the headstock, and driving a larger and single-speed pully on the left end of the back-shaft, which runs underneath the tool board. These are not shown in the figures. At the opposite or right hand end of the shaft, a stepped pully (seen in Fig. 2) drives a similar stepped but reverse pully on the leading screw. This last is tightened or slackened with a conical fitting, so that it need not run with the screw except when required. Thus it is easy to see that the lathe can be driven through back gear and change wheels, the clutch being in; or that by throwing out the clutch, light work can be done automatically by means of the back-shaft; also, the clutch being out, that the rest can be operated by hand alone, without in any way interfering with the wheels on the headstock. More than this, the clutch provides an automatic throw out, or safety stop, when cutting up screw threads, and when turning plain shouldered work, preventing the tool from travelling too far, and so doing injury. The set-screw on the boss of the fork being slackened, the small rod is slid along until it touches the saddle at that position where the action of the tool is required to be arrested, and there pinched. Whenever, therefore, the saddle arrives at that position in the process of screw-cutting or turning, it thrusts against the rod, and so throws the clutch out of gear, causing instant stoppage of the saddle. The advantage of this simple and efficient arrangement will commend itself at once to those who operate screw-cutting lathes.

To many the chief interest in this lathe will centre in its front slide rest, which is an embodiment of an idea long advocated by many amateur turners. One of its advantages is that it can be slid along to the right hand of the poppet out of the way, in order to do plain hand turning with the Tee rest. Often in common lathes the L rest is used for this, but the arrangement is much more awkward and in the way than hand rest and Tee. The other advantage claimed is that there will be less abrasion of the wearing surfaces with a front slide than with the top saddle, between which and the bearers the chips and dust are apt to gain access. The objection to the front slide is a supposed lack of stability, due to its overhang. This is a question of fitting; actually we can say that no want of stability is perceptible, two well-fitting adjustable strips maintaining the saddle perfectly rigid against the thrust of the tool. The saddle is operated by means of the handle seen in front, which actuates a spiral wheel gearing into a second wheel encircling the nut of the leading screw. There being no rack traverse, this is also the only means by which the saddle can be run back in readiness for another cut. The action is very smooth, and the resistance so slight that the rest can be traversed rapidly, notwithstanding the number of revolutions required, one turn of the handle giving $\frac{1}{8}$ in. of traverse. There is a divided circle on the front end of the saddle encircling the spindle, so that the traverse of 1-200th of an inch can be read off. The surfacing slide is actuated by a screw of ten threads per inch, which, with its head divided into tenths of an inch, gives a reading to the 1-100th of an inch. This capacity of minute adjustment, both for pitch and depthing of screws, renders the multiplication of parts of the ordinary compound rest superfluous. The tool-holder in Fig. 1 and the drilling spindle in Fig. 2 are carried in a socket which is bolted to the Tee slots in the surfacing slide. This socket, and also the socket of the Tee rest itself, is clamped by means of a divided lug and pinching screw, which does not bruise the shank, and affords better security than the ordinary form of tightening screw. The poppet mandrel has a screw of ten threads per inch, hence a single turn of the handle moves it one-tenth of an inch. The mandrel body itself is marked with inches and eighths of an inch. The headstock mandrel is bored hollow for stud turning. The driving axle has a novel provision for lubrication not shown in the figure. Hollow brass cups closely embrace each end of the axle, and extend a little way over the pivots. These therefore prevent the oil from being thrown off while driving, and retain it while the lathe is at rest, and thus avoid waste and dirty floors.

THE "SKIPJACK" TYPE.—Messrs. Laird Brothers, of Birkenhead, have contracted with the Admiralty for the supply of the torpedo gun vessel *Skipjack*, with machinery of 4,500 H.P., estimated to propel her at a speed of 21 knots per hour. The *Skipjack*, which is the first of a new type, is to be built of steel, with a displacement of 730 tons. Six vessels of the class are to be built for the navy during the ensuing financial year.

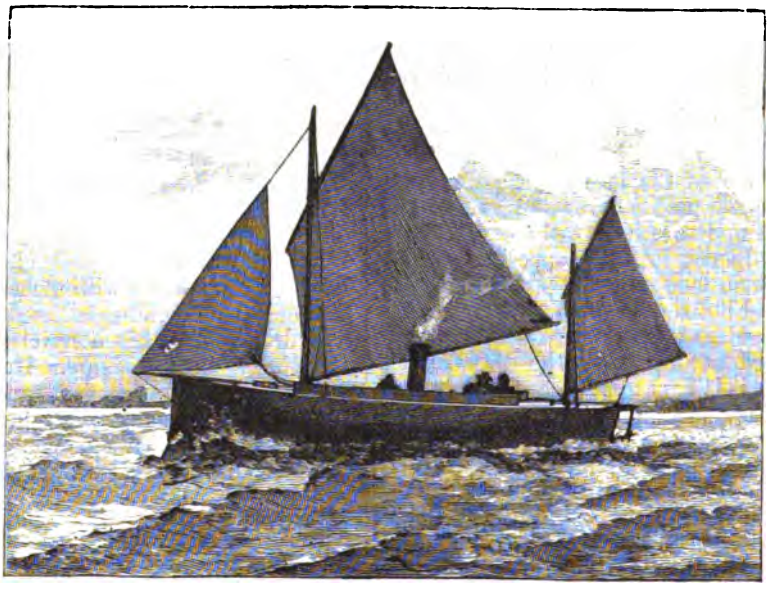
CORY BROTHERS & CO. (LIMITED.)—The business of Messrs. Cory Brothers & Co., at Cardiff, Newport, London, and elsewhere, has been transferred to a limited liability company. The new undertaking acquires the interest of Messrs. Cory Brothers in the Galli, Tyngbedw, and other collieries in the Rhondda Valley, the coal wagons and railway rolling plant and shares in steamships and water works companies, and in the Aden Coal Company (Limited), and the Brazilian Coal Company (Limited). The new company has been registered with a capital of £1,000,000, in £100 shares.

NEW TYPE OF SUBMARINE BOAT.—Mr. Chapman and the Brothers Brin have, it is stated, recently invented a new type of submarine boat, the propulsion of which is effected by the combustion of a mixture of compressed oxygen and petroleum spray, either in a gas engine or in the furnace of a steam boiler. The oxygen, which is prepared by the well-known Brin process, is compressed to 80 atmospheres, at which pressure a considerable quantity can be stored in a comparatively small space. The immersion of the vessel is effected by a centrifugal pump which draws in water at the bottom of the boat, and forces it out vertically through two reaction tubes. The depth of immersion is automatically controlled by means of electricity.

THE "NYASSA" DELTA METAL STEAM CANOE.

THE accompanying illustration represents a miniature craft, recently built of the well known "Delta" metal manufactured by Mr. Alexander Dick, of 110, Cannon Street, London, E.C.

The *Nyassa* has been built by Messrs. Simpson and Strickland, of Dartmouth, for the Universities African Mission Society, and is intended for service on the lake Nyassa. For convenience of transport she has been constructed in three sections, having when put together a total length of 21 ft., with a beam of 7 ft., and a depth of 3 ft., the draught of water with her engine and boiler on board being 16 in. The fore and aft compartments are provided with air-tight bulkheads, and a triangular "Delta" centre board is carried in the middle compartment. There is an opening or well in her deck



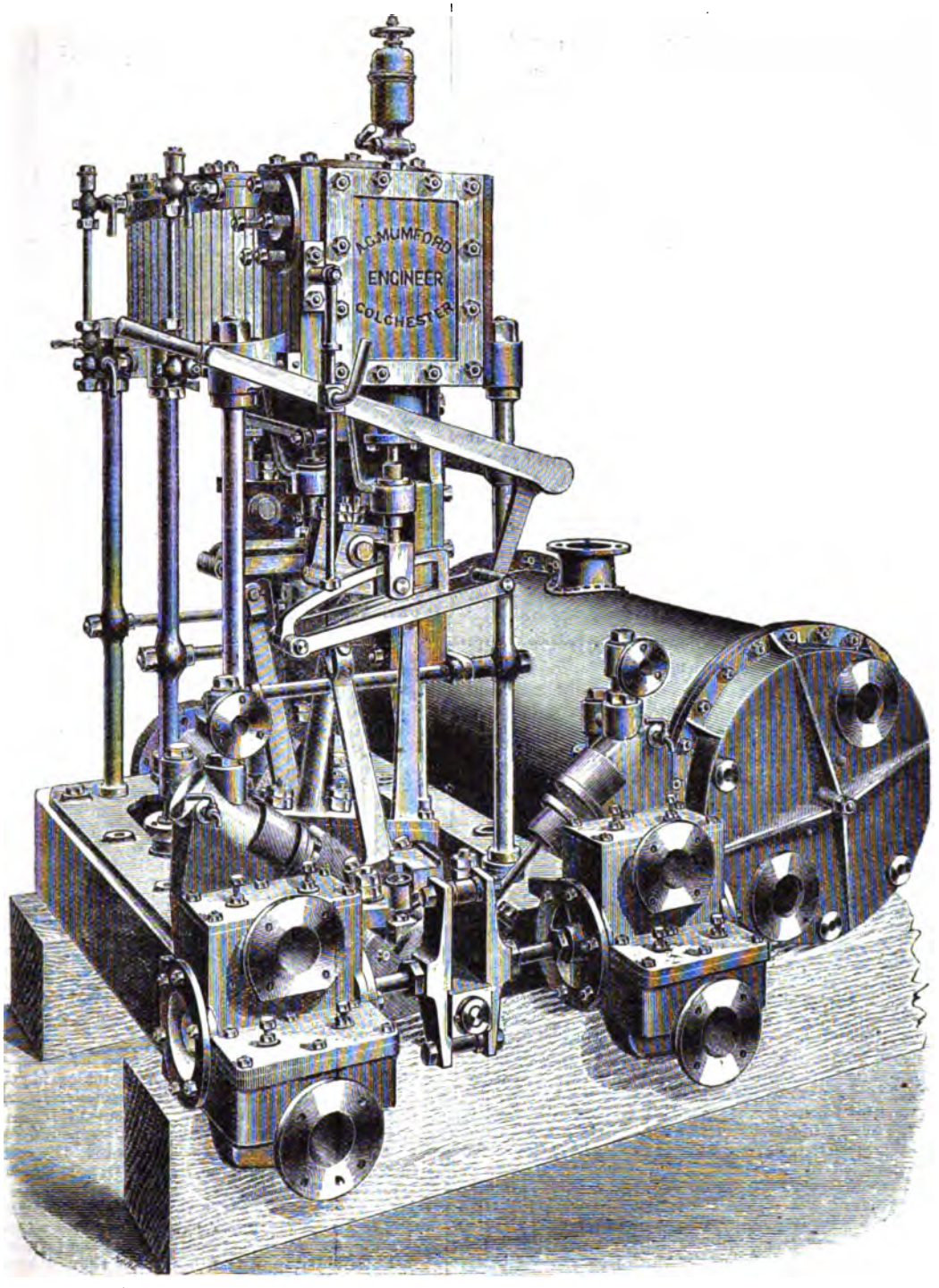
amidships 9 ft. 6 in. in length by 4 ft. wide, fitted with a combing 6 in. high, with a "Delta" gunwale. As shown, she carries two masts, and is fitted with a jury rudder post, between which and the stern post her three-bladed screw propeller is placed. When required for sailing only, the propeller and shaft can be removed with the rudder post, the rudder being then attached directly to the stern post. The *Nyassa* was recently tried at Dartmouth with seven persons on board, and with a steam pressure of 100 lbs. she made seven miles an hour, while with her sails only and the wind abeam she made six miles an hour, dragging her screw, the boat proving very handy in both cases. The boiler furnace is adapted for burning wood and other similar fuel found in tropical climates.

We need scarcely point out the advantages of "Delta" metal for the construction of craft designed for such use as the *Nyassa*, for in tropical climates steel hulls rust through in a very short time, while wooden hulls are still worse off owing to the ravages of rot, weeds, and, in central Africa, of ants, while the weight, to say nothing of the rusting properties, of iron necessary to ensure equal strength puts it out of the question. Again, for the construction of torpedo and submarine boats where everything has to be sacrificed to speed, no better material than "Delta" metal exists, for in time of war, when regular docking and frequent painting would be impossible, the hulls, built, as they now are, of thin steel plates, would be so weakened in a very short time as to be absolutely unseaworthy, and so rendered a source of constant anxiety to ourselves rather than being a menace to the foe.

When rolled, "Delta" metal is stronger than ship-building steel, while its wonderful resisting powers, as regards corrosion, were clearly shown in an article on the "Relative Corrosion of Metals," which appeared in our issue of last August (p. 167). Here it was shown that while a bar of iron lost, roughly, 46 per cent. of its weight, and a bar of steel 45 per cent., a bar of "Delta" only lost 1·2 per cent., the bars in each case having the same surface area and being exposed each for the same length of time to the same corrosive influences.

We understand that the Russian Government have already constructed a number of composite "Delta" torpedo-boats for river service, while a number of steam launches are now afloat that have been built entirely of "Delta."

THE WARSPITE.—Another important addition has been made to the effective strength of the Navy by the completion for sea of the new first-class armour-plated cruiser *Warspite*, which has been passed into the First Division of the Medway Steam Reserve as fully equipped and ready for immediate service. The *Warspite* is a most formidable vessel, having a displacement of 8,400 tons and engines of 10,000 H.P., capable of propelling her at a speed of about 17 knots per hour. She is armed with four 9·2 in. 22-ton steel breechloading guns and six 6 in. 5-ton breech-loading guns, which are mounted upon *Vavasseur* fittings. She also carries eight three-pounder and six-pounder quick-firing guns, and a strong equipment of Gardner and Nordenfelt machine guns and Whitehead torpedoes.



COMPOUND SURFACE CONDENSING ENGINES.

For description see page 64.

COMPOUND SURFACE CONDENSING ENGINES.

THE illustration on page 63 represents a pair of compound surface condensing engines, constructed by Mr. A. G. Mumford, of Culver Street Iron Works, Colchester, and designed for use on board yachts, small tugs, or cargo boats, and which are of the same type as supplied to a foreign government, to whom they have given the greatest satisfaction in every way.

The engines illustrated have cylinders 7 in. and 14 in. diameter by 8 in. stroke, and are proportioned throughout for running at high speed, great care having been taken to make the construction as light as possible, consistent with strength, stability, and large bearing surfaces.

As will be seen, the cylinders are mounted on turned and polished steel columns, connected by cross stays, the bed plate being so constructed as to allow of the air and circulating pumps being fixed to it. This arrangement not only economises space, but by allowing the pumps to be worked in the manner shown, from the end of the crank shaft, does away with the usual levers, always an objectionable feature in high-speed engines.

The condenser is independent of the engine framing, and to ensure the utmost lightness, is made of galvanised sheet steel or copper, brass tubes and tube plates being provided.

While the design shows that ample strength and compactness have been provided, yet all the parts lie "snug," and can be readily got at, qualifications too often overlooked by designers of high-speed machinery.

Mr. Mumford has long and successfully made a speciality of this class of engines, and we may safely say that for design, quality of workmanship, and materials, the productions of the Culver Street Works rank with the highest.

ECONOMY-TRIALS OF A NON-CONDENSING STEAM ENGINE.

AT the Ordinary Meeting of the Institution of Civil Engineers, on Tuesday, March 13th, the President, Mr. Bruce, being in the chair, the paper read was on "Economy-Trials of a Non-Condensing Steam-Engine—Simple, Compound, and Triple," by Mr. P. W. Willans, M.Inst.C.E.

The author described a series of economy-trials, non-condensing, made with one of his "central-valve" triple-expansion engines, with one crank, having three cylinders in line. By removing one or both of the upper pistons, the engine could be easily changed into a compound or into a simple engine at pleasure. Distinct groups of trials were thus carried out under conditions very favourable to a satisfactory comparison of results. No jackets were used, and no addition had therefore to be made to the figures given for feed-water consumption on that account. Most of the trials were conducted by the author, but check-trials were made by Mr. MacFarlane Gray, Professor Kennedy, Mr. Druitt Halpin, Professor Unwin, and Mr. Wilson Hartnell. The work theoretically due from a given quantity of steam at given pressure, exhausting into the atmosphere, was first considered. By a formula deduced from the $\theta\,\phi$ diagram of Mr. MacFarlane Gray, which agreed in results with the less simple formulas of Rankine and Clausius, the lbs. weight of steam of various pressures required theoretically per indicated H.P.-hour were ascertained. A description was then given of the main series of trials, all at 400 revolutions per minute, of the appliances used, and of the means taken to ensure accuracy. A few of the results were embodied in the table. The missing quantity of feed-water at cut-off, which, in the simple trials, rose from 11·7 per cent. at 40 lbs. absolute pressure to nearly 30 per cent. at 110 lbs., and at 90 lbs. was 24·8 per cent., was at 90 lbs. only 5 per cent. in the compound trials. In the latter, at 160 lbs., it increased to 17 per cent.; but on repeating the trial with triple-expansion, it fell to 5·46 per cent., or to 4·43 per cent. in another trial not included in the table. On the other hand, from the greater loss in passages, &c., the compound engine must always give a smaller diagram, considered with reference to the steam present at cut-off, than a simple engine, and a triple a smaller diagram than a compound engine. Nevertheless, even at 80 lbs. absolute pressure, the compound engine had considerable advantage, not only from lessened initial condensation, but from smaller loss from clearances, and from reducing both the amount of leakage and the loss resulting from it. These gains became more apparent with increased wear. The greater surface in a compound engine had not the injurious effect sometimes attributed to it, and the author showed how much less the theoretical diagram was reduced, by the two small areas taken out of it, in a compound engine than by the single large area abstracted in a simple engine. The trials completely confirmed the view that the compound engine owed its superiority to reduced range of temperature. At the unavoidably restricted pressures of the triple trials, the losses due to the new set of passages, &c., almost neutralized the saving in initial condensation; but with increased pressure, say to 200 lbs. absolute, there would evidently be considerable economy. The figures of these trials showed that the loss of pressure due to passages was far greater with high

Intended mean admission pressure .. lbs.	40	90		110		130	150		160		170
Simple, Compound, or Triple	S.	S.	C.	S.	C.	C.	C.	T.	C.	T.	T.
Actual mean admission pressure .. lbs.	40·88	92·65	87·54	106·3	109·3	130·6	149·9	151·5	158·5	158·1	172·5
Percentage ratio of actual mean pressure, referred to L.-P. piston, to theoretical mean pressure	98·2	100	91·3	100·7	94·8	94·2	94·6	84·54	95·9	85·3	85·2
Indicated Horse-Power	16·51	31·61	29·14	33·5	33·0	36.31	38·59	35·69	39·55	35·56	38·45
Feed-water actually used per indicated H.P.-hour—											
Simple .. .. .. lbs.	42·76	26·89	—	26·0	—	—	—	—	—	—	—
Compound .. .. .. ,,	—	—	24·16	—	21·37	20·35	19·45	—	19·19	—	—
Triple .. .. .. ,,	—	—	—	—	—	—	—	19·68	—	19·19	18·45
Steam required theoretically per indicated H.P.-hour .. .. lbs.	34·67	19·24	19·86	17·9	17·65	16·25	15·23	15·16	14·87	14·9	14·36
Percentage efficiency	81·1	71·5	82.2	68·8	82·5	80·0	78·3	77·0	77·4	77·6	77·8
Percentage of Feed-water missing at cut-off in H.H.-P. cylinder	—	—	—	—	9·5	11·7	15·1	14·84	17·0	12·06	15·33
Ditto H.-P. cylinder	—	—	5.0	—	16·25	19·1	20·6	22·12	21·3	22·11	24·21
Ditto L.-P. cylinder	11·7	24·8	16·2	29·56	16·25	17·55	20·69	18·01	19·56	18·81	19·25
Percentage of Feed-water missing at end of stroke in L.-P. cylinder	10·4	18·83	14·25	21·63	16·59						

than with low-pressure steam, and that pipes and passages should be proportioned with reference to the weight of steam passing and not for a particular velocity merely. The author described a series of calorimetric tests upon a large scale (usually with over two tons of water), the results of which were stated to be very consistent. After comparing the rates of initial condensation in cases where the density of steam, the area of exposed surface, and the range of temperature were all variables, with other cases (1) where the density was constant, and (2) where the surface was constant, the author concluded that at 400 revolutions per minute, the amount of initial condensation depended chiefly on the range of temperature in the cylinder, and not upon the density of the steam, or upon the extent of surface; and that its cause was probably the alternate heating and cooling of a small body of water retained in the cylinder. The effect of water intentionally introduced into the air-cushion cylinder, corroborated the author's views, and he showed how small a quantity of water retained in the cylinder would account for the effects observed. At lower speeds surface might have more influence. The favourable economical effect of high rotative speed, *per se*, was very apparent. In a trial with a compound engine, with 130 lbs. absolute pressure, the missing quantity at cut-off rose from 11·7 per cent. at 405 revolutions to 29·66 per cent. at 130 revolutions, the consumption of feed-water increasing from 20·35 lbs. to 23·67 lbs. This saving of 14 per cent. was due solely to increase of speed. Similar trials had been made with a simple engine. In one simple trial at slow speed the missing quantity rose to 44·5 per cent. of the whole feed-water. The author compared a series of compound trials, at different powers, with 130 lbs. absolute pressure, and various ratios of expansion, with a series giving approximately the same powers at a constant ratio of expansion, but with varying pressures, being practically a trial of automatic expansion against throttling. Starting with 40 indicated H.P., 130 lbs. absolute pressure, four expansions, and a consumption of 20·75 lbs. of water, the plan of varying the expansion, as compared with throttling, showed a gain of about 7 per cent. at 30 indicated H.P., but of a very small percentage when below half-power. If the engine had an ordinary slide-valve, the greater friction, added to irregular motion, would probably neutralize the saving, while if the engine were one in which initial condensation assumed more usual proportions, the gain would probably be on the side of variable pressure. Even as it was, the diagrams showed that the missing quantity became enormously large as the expansion increased. Judging only by the feed-water accounted for by the indicator, the automatic engine appeared greatly the more economical; but actual measurement of the feed-water disproved this. The position of the automatic engine was, however, relatively more favourable when simple than when compound. In conclusion, the author referred to a trial with a condensing engine, at 170 lbs. absolute pressure, in which the feed-water used was 15·1 lbs., a result evidently capable of further improvement, and to an efficiency trial of a combined central-valve engine and Siemens' dynamo, made for the Admiralty, at various powers. At the highest power the ratio of external electrical H.P. to indicated H.P. in the engine was 82·3 per cent. Taking the thermodynamic efficiency of the engine at 80 per cent., that of the combined apparatus would be nearly 66 per cent.

HER MAJESTY'S SHIP "VICTORIA."

ON April 6th the armourclad *Victoria*, which has been built for the British Navy by Sir William G. Armstrong, Mitchell and Co., moved down the river Tyne from Elswick Shipbuilding Yard, where she has been built, to the Quayside, Newcastle. Here she remained one day, and then proceeded to Chatham for her armour. She was convoyed by the *Valorous*, which arrived in the Tyne on Thursday morning, April 5th, with the *Victoria's* crew on board. The departure of the huge ironclad from Elswick was witnessed by immense crowds of spectators, the banks on both sides of the river and the three bridges through which she safely passed—the Redheugh, the High Level, and swing bridge—being studded with onlookers. The passage through the ponderous swing bridge, one of the productions of the Elswick firm, was witnessed by the members of the River Tyne Commission, among whom was Mr. J. Stevenson, M.P., the chairman. The Elswick yard, where the *Victoria* has been built, it may be stated, is ten miles from the mouth of the Tyne, and the vessel being the heaviest ever built on the river, and, indeed, at the time of her launch, the heaviest ever built in the United Kingdom, there was reason for the interest that was aroused by her movement down the river. Everything was carefully managed, however, and the departure of the giant fighting ship from her cradle was successfully carried out. With the completion of the vessel and her departure for Chatham are published, for the first time, details of the dimensions, construction, and armour of the *Victoria*. Her main dimensions are—length between perpendiculars, 340 ft.; beam, 70 ft.; mean draught with full armament and full coal stores, 26 ft. 9 in.; displacement, when completely equipped, 10,500 tons; and the power of the engines is 12,000-horse indicated. Her armament consists of two guns of 110 tons each and 16¼ in. calibre, placed in a turret forward; one 11 in. gun of 30 tons, placed aft on the upper deck; 12 6 in. 5-ton broadside guns in a turret on the main deck abaft the 110-ton guns; 12 6-pounder rapid-firing guns on the spar deck; and nine 3-pounder rapid-firing guns, some on the decks and some in the mastheads. There are also two 1 in. Nordenfelt two-barrelled guns, and four ½ in. Nordenfelt guns, which will be placed on the spar deck or in the mastheads. The turret in which the two 110-ton guns are to be placed is covered with bound steel armour 17 in. thick, and the base of the turret is protected by a battery wall completely enclosing it with 18 in. thick of bound armour, which protects also the mechanism for bringing up the ammunition and driving the gun. The guns will fire a projectile of 1,800 lbs. weight in any direction from straight ahead to 50 or 60 degrees abaft the beam on either side, the charge of gunpowder being no less than 960 lbs. To the rear of this turret on each side of the vessel is a long strongly protected battery of six 5-ton guns of 6 in. calibre, projecting through protected ports. These batteries extend from the turret to the station for the 10 in. gun, which is a stern gun of great range. The rapid-firing guns will be on the spar deck, and at the head of the steel mast which is yet to be fitted, fore and aft and on each side, are four torpedo guns above water, and it is intended subsequently to fit four under-water torpedo guns, two on each broadside. The *Victoria* will also be fitted with torpedo defence netting and with boats for torpedo service in action. The vessel will be commanded from a conning tower of armour of from 10 in. to 12 in. thick placed above the lever of the turret, which will have means of communication with the engine-rooms and important parts of the vessel and of steering the ship by hydraulic power. She is the first ship fitted with new designs of engine telegraphs, lever handle for giving orders on bridge dial, works forward for ahead, and aft for astern; engine room dial fitted with duplex gong, a deep bell with ahead orders and shrill astern, manufactured by Messrs. Chadburn & Co., Liverpool.

The vessel throughout is lighted by electricity, by which means also the guns will be fired, while the loading of the heavier guns will be carried out by means of hydraulic mechanism. The protective armour of the *Victoria* is very massive. For protection against heavy projectiles she has on each side a belt of armour extending three or four feet above and below the water-line, and 152 ft. in length of compound steel plating 18 in. thick. This armour encloses all the vital parts of the ship, including the propelling machinery, the magazine mechanism, the boxes of the funnels, and the structure carrying the base of the turret. A protective flat deck of 3 in. thickness of steel is carried over at the level of the top of this armour belt throughout its length, and continued to the bow and stern of the ship. At the level of the bottom of this armour belt, at its forward end, is superimposed an 18 in. belt, which protects the base of the turret itself with armour 17 in. thick. Thus from the stem to the stern the ship is thoroughly protected either by deck plates or by massive walls of bound armour.

The propelling power, which is placed below the protective decks, consists of twin screws of 16 ft. diameter, each of which is driven by triple-expansion engines, manufactured by Messrs. Humphrys & Tennant, London. The cylinders of the engines are respectively 43, 62, and 96 in. in diameter, and the stroke of the piston 51 in. These engines are intended to be worked at a speed of 95 revolutions per minute, and will collectively develop a force of 12,000 I.H.P., giving to the vessel a speed of about 16¼ knots. The *Victoria* will have a coal storage of 1,200 tons, sufficient to carry the vessel at full pressure over 1,600 nautical miles, but at the more leisurely speed of, say 10 knots, over a distance of 7,000 miles—a long cruise. Ample magazine accommodation is got in the internal part of the ship owing to her great beam, so that even for the 110-ton guns she will be able to carry 160 rounds of projectile and powder. The fittings of the vessel and the accommodation for the officers and crew are exceedingly fine, and a striking feature of the whole vessel is the extent to which manual labour has been superseded by hydraulic power, not only in the manipulation of the heavy armament, but in the engine-room, and, indeed, in every part of the ship.

FEED-HEATERS.

(Continued from Page 402, Vol. 9.)

IN our March issue it was seen that by connecting a feed-heater to the I.P. receiver, and allowing only sufficient steam to pass to it as would raise the temperature of the feed-water to 290 degs., the efficiency of every pound of steam passing from the boiler to the engines was increased by about 15 per cent. But the work done in the engine by this same pound of steam is naturally less than if no feed-heater were connected. In most triple-expansion engines the cylinders are so designed and proportioned that the power developed in each shall be about the same; that is, one-third of the work done by every pound of steam in passing through the engines is done in each of the H.P., I.P. and L.P. cylinders. By connecting a feed-heater to the I.P. receiver, we have already seen that for every pound of steam passing through the H.P. cylinder only five-sixths of a pound finds its way through the I.P. and L.P. cylinders to the condenser; and if we assume, as we are perfectly justified in doing, that the work done by a *quantity* of steam in an engine is proportional to its weight, then the power developed in the I.P. and L.P. cylinders is only five-sixths of that in the H.P. cylinder. If we, therefore, represent the total power of a triple-expansion engine unencumbered with a feed-heater by unity, then the power developed in the same engine when a heater is connected to it would be

$$P = \tfrac{1}{3} + \tfrac{1}{3}\,(\tfrac{1}{3} + \tfrac{1}{3}) = \tfrac{5}{6}$$

Or, in other words, the effect of warming up the feed-water by steam from the I.P. receiver is to reduce the power of the engine one-ninth, or about 11 per cent., for every pound of steam passing through it. Therefore, to maintain the same speed and power as the engines were designed to develop, a greater quantity of steam in the proportion of 100 to 89 will be required; or, reduced to simple figures, $1\frac{1}{8}$ lbs. of steam are required to supply the same power as would be developed by 1 lb. when the feed-heater was not used. By using a heater we thus have the efficiency of the *engine* reduced from unity to $\frac{89}{100}$, while the efficiency of the *steam* has been increased from unity to $\frac{1}{1\frac{1}{8}}$. The total efficiency is the product of all the various efficiencies, and is therefore equal to

$$E = \tfrac{89}{100} \times \tfrac{1}{1\frac{1}{8}} = 1{\cdot}0235$$

This shows us that there is an economy of 2·35 per cent. by attaching a feed-heater to the I.P. receiver. This result agrees very closely with the results gained by actual experience, and which have proved that a decided economy of about 2 per cent. can be obtained by the judicious use of feed-heaters of this description. By lowering the temperature of the feed-water below 290 degs. a much greater economy can be obtained; and by connecting the heater to the L.P. receiver a probable saving of from 4 to 5 per cent. would follow. But should it be found necessary to use salt water for the feed, then the sulphates and other scale-forming salts, instead of being precipitated in the heater, would be carried into the boiler and deposited on the heating surfaces, where, if an accumulation were allowed to take place, and a scale of only a small thickness formed, the effect would be to more than neutralise any saving of fuel made by the use of hot feed-water, by the greater expenditure of fuel required on account of the scale. Also one of the strong points adduced in favour of heaters is the prevention of unnecessary strains in the boiler itself, owing to different temperatures existing in the top and the bottom of the boiler; and if we have the feed-water entering the boiler at a temperature less than 290 degs., then too great a difference of temperature exists in the steam space and in the lowest water space. As all modern engines are fitted with evaporators or other distilling arrangements for making a sufficient quantity of fresh water from sea water to compensate for all the losses (such as steam for auxiliary purposes and leakages), that lessen the quantity of water in the boiler, it should not be necessary ever to admit sea water to the boiler, and no scale should therefore ever be found there; and it is principally due to this fact that an apparent economy follows from using feed-heaters which work on principles altogether at variance with those of economy.

We have already referred to the two great losses of heat in a steam engine, which render it such an imperfect and inefficient agent for the transformation of heat into mechanical energy, viz., the loss arising through the escape of the products of combustion at a very high temperature, and the loss of the greater part of the heat in the steam itself in the condenser.

All attempts to rob the exhaust steam of a portion of its heat by intercepting feed-heaters in the passage to the exhaust only result in an impaired vacuum, and a consequent diminished power of the engine; while under the most favourable circumstances the feed-water is not raised to a sufficiently high temperature to be of much service in ridding the water of its air and impurities before it enters the boiler, or for preventing unequal expansion in the boiler. But with the other source of waste of heat, there is now a probability that it will in the future be greatly reduced. The use of forced draught in properly designed boilers should lead to a great economy being effected. With natural draught only for promoting combustion in the furnaces, it was necessary that either the chimney should be of great length, and a free, unobstructed channel allowed for the escaping gases, or the temperature of the products of combustion should not be less than 600°. Without either of these conditions only a very slow and imperfect combustion could be obtained. In a marine engine lofty chimneys are altogether out of the question; and so, up till the present time we find that the 25 pounds weight of gases that escape up the chimney for every pound of fuel burnt, have to possess a temperature of at least 600° to induce a proper rate of combustion. With proper forced draught, we have in the first place only 19 pounds of gases going up the chimney for every pound of fuel burnt; and as the current of air through the furnaces is not caused by the convection of these gases, but by a pressure below the fire-bars, there is no reason why the temperature in the funnel should be much greater than that of the steam in the boiler. In properly designed boilers of the future we may expect to find that the loss of heat due to the escaping products of combustion has been reduced by the difference in the quantity of heat in 25 lbs. of a mixture of carbonic acid and air at 600°, and that in 19 lbs. of a similar mixture at only 400°. Part of the heat in the gases of combustion may be recovered by fitting feed-heaters in the uptakes. When combustion depended on natural draught, then anything which tended to check the free escape of the gases, or to lower their temperature, was rightly thrown on one side, especially in ships that had to steam in tropical countries with little wind to help the fires; but now the current of air to the furnaces being produced by purely artificial means, it does not matter so much if the passage to the funnel is somewhat choked, and the temperature can be reduced to almost that of the steam in the boiler.. Feed-heaters, therefore, placed in the uptake or root of the funnel of a boiler worked under forced draught, should greatly conduce to economy of fuel. There are, however, certain drawbacks and objections to this form of feed-heater, that up till the present time have prevented it being extensively adopted. It has to be much larger than a heater in which steam is the active agent; also it is more difficult of access for examination or repair, and, being out of sight, is likely to become neglected. There is also the possibility that through shortness of water and other causes, some of the parts may get overheated, and eventually burst, the same as a boiler. And lastly, in the event of the fans for producing the forced draught being disabled, the heater in the uptake would prove a serious obstacle in the passage of the gases up the funnel, and would therefore check a draught created by natural means.

While, then, feed-heaters placed in the uptakes of boilers worked under forced draught produce greater economy than all other systems, yet there are stronger practical objections to their adoption than with other systems. Those heaters in which the water is made hot by steam from the I.P. receiver appear to combine economy (though small in extent) with all the practical advantages to be derived from sending the water into the boiler at a high temperature; while those heaters which receive steam direct from the boiler, whether they are fitted inside or outside of the boiler, cannot be said to be economical in fuel, although by their many other good points, in common with the other types of heaters, they certainly prolong the life of a boiler, and reduce the cost for repairs very considerably.

A NEW LIFE-BUOY.—The Reel life-buoy, a remarkable invention by an American naval officer, has just been fitted to several ships of the United States navy. The life-buoy is suspended from a small platform at the stern of the ship. The reel is on a pivot, and around it is wound a steel wire or rope, as desired, one end of which is attached to the buoy. This rope may be paid out for a distance of half a mile, and the reel is provided with a crank and brake. The buoy, which can at once be dropped into the water, contains fire-friction primers and a Very signal-pistol with waterproof cartridges, thus enabling the man in the water to signal the ship at night; and attached to the buoy is a small locker containing biscuit and a flask of stimulants, so that if the rope should break and the buoy get adrift the man would have food enough for two or three days.

THE MERCANTILE MARINE AS A ROYAL NAVAL RESERVE.

LORD CHARLES BERESFORD, M.P., presided, on March 7th, at the Royal United Service Institution, when Lieut. W. C. Crutchley, R.N.R., read a paper, which naval experts pronounced to be of a valuable character, "On the condition of the Mercantile Marine, *personnel* and *matériel*, with a view to its more complete utilization as a reserve for the Royal Navy."

The lecturer commenced by pointing out that the traders of old on the sea cultivated the arts of war when seeking the necessaries of peaceful life. If this state of things applied when the British people were few, it was more necessary now, when our fleets covered the seas, and there was no corner of the earth where the British ensign was not seen. The questions now were—Are our ships worse than our neighbours', or have we so deteriorated as a nation that because we are so numerous we are not to take advantage of our numbers to provide for our own safety? He approached the discussion of the questions, he said, from the point of a thorough knowledge of the merchant service, and with a keen desire to see it take its rightful place in the service of the country. The first point he dealt with was that in regard to the *personnel*, and he asked how the men of the merchant navy belonging to the Royal Naval Reserve, and permitted to sail to all parts of the world, could be called together if there should be a sudden struggle for the national life. His suggestion was that the men and officers should be put into the same ships; and this brought up the point as to the effect of the Declaration of Paris in regard to armed merchant vessels. Our vessels, he said, would be at a disadvantage if this Declaration should be of effect, for the chief danger to our commerce would lie in attack from armed merchant vessels, and the surrender of vessels without fighting would be opposed to the old English law and to the instincts of our people. As to the combination of the ships, officers, and men, he insisted that this could be met by all new over-sea contracts for mails making it imperative that the ships should fly the blue ensign and comply with the regulations under which that ensign was borne. The vessels would be first class and would have first-class men, the officers, too, being commissioned, it being made their interest to have commissions. He dwelt upon the importance of retaining these officers, who knew well the sea, every corner of the coasts, and all the work which would be required. Then, too, he urged that engineer officers should be induced by retainers to join the reserve, and he put this as one of the first requirements of the reserve. Then as to the officers, he gave a list showing that there were only 141 places filled out of 920 needed, notwithstanding that there were many officers of the mercantile marine well qualified to hold commissions. He pointed out that the force of nearly 18,000 men had no petty officers, and urged that this should be remedied, especially as "Jack," like all mankind, loved promotion, and would be proud of the blue anchor on his arm. The lecturer then laid down suggestions for systems of tactics by merchants, in change of routes, and carrying communications, and he suggested means of signalling, insisting upon a changed system being organized.

The discussion was opened by Captain Colomb, M.P., who considered that excellent suggestions were given in the paper.

Lord Charles Beresford, in closing the discussion, said such a paper as they had heard read would do immense good, as it dealt with the question of organization—one of the most important of the many questions before the country. He discussed the question of armed cruisers, and explained the services these would discharge in being a means of communication on the outbreak of war with ports where merchant vessels would be congregated and as runners for the fleet, and he stated that steps had been taken whereby armaments could be put on board merchant ships. He thought the suggestions in the paper as to ships changing their routes in war excellent, and as to other points he insisted upon the necessity of publicity being given as to the causes of expenditure on our navy. As to suggestions that the Admiralty had not looked at all the matters in relation to the reserve in the merchant service to the Royal Navy, he could say that it was impossible for the Admiralty, under its present constitution and its present system, which was utterly rotten, to deal with all these matters. Of course he meant nothing reflecting upon his late chief or his late colleagues, by whom great reforms had been carried out; but he should do his level best to deal with the system.

CELLULOID has recently been used as a substitute for copper in sheathing vessels, and is said to answer the purpose well.

LAUNCH OF H.M.S. "NILE."

ON March 27th this new ironclad was launched at Pembroke Dockyard. She is one of the most noteworthy vessels of the present age, being the heaviest ship yet constructed, and being, it is expected, a vessel that will meet with the approval of naval men which no other iron ship has yet done. She is of the turret and barbette class, and is possessed of all the best fighting and sea-going capabilities of each. The magazine, which has been placed in such a position that the hydraulic lift will rise with its charge to the breech of the guns, is protected by the thickest armour on the ship, and is also protected by the coal bunkers on either side. The *Nile* is 345 ft. long between perpendiculars, and 73 ft. broad. Her load draft of water will be 27 ft. forward, and 28 ft. when fully equipped for sea, and her displacement tonnage is 11,940 tons. Her coal storage is 900 tons, which is carried in fore and aft bunkers. Her armament is to consist of four 13½-in. 67-ton breechloading guns, six 36-pounder quick-firing guns, eight 6-pounder, and ten 3-pounder Hotchkiss quick-firing guns, machine, boat, and field guns, and twenty-four Whitehead torpedoes. The turret guns will fire a projectile weighing 1,250 lbs. with a powder charge of 630 lbs. The 36-pounders will be mounted between the turrets on the upper deck, and will be protected from rifle fire by two thicknesses of ½-inch plating on the sides of the ship, and at each end of the battery by an armour bulkhead 5 in. thick, fitting upon 6 in. of backing, and an inner skin. The 6-pounder Hotchkiss guns will be fought from the spar-deck, bridge, stern-posts, and military tops.

The *Nile* will be propelled by two sets of triple-expansion vertical engines by Messrs. Maudslay & Co., which, with an I.H.P. of 12,000, are expected to drive the ship at the rate of 16½ knots. The boilers are six in number. The radius of steaming distance is officially stated to be 1,050 nautical miles at full speed, and 5,500 at ten knots. But all calculations of this sort are vitiated by the fact that the coal stores are not exclusively used for propelling purposes. The ship's galleys and fires will consume nearly a ton a day, while the fuel used in condensing amounts to about five tons a day. The *Nile* will also be original in the disposition of her funnels, since instead of having one behind the other, as has hitherto been universally the case, they will be abreast.

The ship will be fought from the pilot tower on the spar deck, and from two conning towers at the side, and her steering will be controlled from five stations by steam power and also by hand gear from below the protected deck. Her propellers were fixed in position before launching, two blades being secured on each shaft.

The *Nile* was built by Mr. Millard, Assistant Constructor, under the direction and superintendence of Mr. George Malpas, Constructor, and Mr. J. C. Froyne, Chief Constructor, from the designs of Messrs. Barnes & Morgan, of the Admiralty Constructive Department.

ANGIER BROTHERS' STEAM FREIGHT REPORT.

FREIGHTS since our last report have materially improved in the Black Sea trades homewards and outwards generally; in other respects there is little or no change. China coasting freights continue good, and there is a fair demand for steamers on time employment in those waters. A high rate was paid for a steamer to run between Japan and Vancouver on the Canadian Pacific line. For cross voyages between Burmah and India ports fair rates are paid. Homeward employment from all India ports is still unremunerative taken alone, but together with present outward rates the round leaves a good margin with new steamers. From the Azoff, Danube, and Black Sea a large number of steamers has been engaged at advancing prices for April to June loading, which should leave fair profits. Mediterranean and Baltic trades are better, with more inquiry and rather higher figures. All American business continues most depressed, showing little but loss for the work done. Outward rates generally have been well maintained, with an advance in most cases, and high rates have been paid for special wants.

In shipbuilding a few more orders have been booked, and the trade bears a hopeful aspect; engineers continue very fully employed.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from March 24th to April 23rd, 1888:—

Abbott, Wm. J., chief engineer to the *Buzzard*, to date April 17th.
Agnew, John W., engineer to the *Asia*, to date April 7th.
Allen, Alfred J., staff engineer to the *Boadicea*, to date April 24th.
Baldwin, Henry St. C., assistant engineer to the *Benbow*, to date April 19th.
Banister, G. W., assistant engineer to the *Conqueror*, to date April 24th.
Barr, Ernest, acting assistant engineer to the *Calypso*, to date April 19th.
Bearblock, Charles W. J., assistant engineer to the *President*, additional for study at the Royal Naval College, to date April 10th.
Bennett, Jas. M. C., chief engineer to the *Polyphemus*, to date April 13th.
Broadbent, Charles, assistant engineer to the *Assistance*, to date April 4th.
Brown, Walter, engineer to the *Swiftsure*, to date April 24th.
Burridge, Robt., staff engineer to the *Aurora*, to date April 20th.
Chapman, Wm. P., assistant engineer to the *Buzzard*, to date April 17th.
Cowper, Ivers, staff engineer to the *Colossus*, to date April 13th.
Darley, A. C., acting assistant engineer to the *Glatton*, to date April 19th.
David, Francis W., acting assistant engineer to the *Volage*, to date April 19th.
Deacon, Albert E. C., assistant engineer to the *Swiftsure*, to date April 24th.
Drake Sidney J., assistant engineer to the *Boadicea*, to date April 24th.
Fincham, Wm. C., chief engineer to the *Excellent*, additional, to date April 7th.
Haddy, Geo. A., chief engineer to the *Phaeton*, to date April 13th.
Hardwick, W. W., assistant engineer to the *Orion*, additional, undated.
Hyde, Thos. H., engineer to the *Rattlesnake*, to date April 13th.
Jacobs, Fredk. G., assistant engineer to the *Benbow*, to date April 19th.
Lewis, B. J., engineer to the *Peacock*, to date March 29th.
Mathews, Edwd., staff engineer to the *Swiftsure*, to date April 13th.
Maudling, Wm. J., chief engineer to the *Pembroke*, additional, to date April 20th.
Meaden, N., chief engineer to the *Excellent*, additional, to date April 7th.
Meaden, Nicholas, chief engineer to the *Arethusa*, to date April 13th.
Medlen, John J. K., chief engineer appointed to the *Melita*, to date March 26th.
Mitchell, Fredk., engineer to the *Boadicea*, to date April 24th.
M'Lean, Harry C., engineer to the *Pigmy*, to date April 4th.
Morris, Geo. H., assistant engineer to the *Himalaya*, to date March 28th.
Noll, Geo. W., assistant engineer to the *Conqueror*, to date April 24th.
Parsons, Geo., chief engineer to the *Champion*, reappointed on promotion, to date April 5th.
Pettit, Wm. J., staff engineer to the *Superb*, to date March 22nd.
Pounds, Thos. H., assistant engineer to the *Boadicea*, to date April 24th.
Power, Wm. T., staff engineer to the *Enchantress*, to date April 1st.
Rundle, Richd. T., chief engineer to the *Hecate*, to date April 20th.
Sampson, John G., fleet engineer to the *Swiftsure*, to date April 24th.
Serle, Rich T., chief engineer to the *Comus*, to date April 14th.
Simmons, Robt. W., assistant engineer to the *Boadicea*, to date April 24th.
Stearn, W. T., assistant engineer to the *Orontes*, to date March 29th.
Stewart, W. H. W., acting assistant engineer to the *Tamar*, to date April 20th.
Taylor, Harry, engineer to the *Ajax*, to date April 13th.
Teed, Harry R., assistant engineer to the *Swiftsure*, to date April 24th.
Thompson, Frank D., assistant engineer to the *Boadicea*, to date April 24th.
Williams, Stephen B., staff engineer to the *Tamar*, to date April 20th.
Willoughby, James T, assistant engineer to the *Swiftsure*, to date April 24th.

INDUSTRIAL NOTES.

THE CLYDE AND EAST OF SCOTLAND.

THE cessation in the placing of new orders upon the books of Clyde shipbuilders and engineers, which began to be felt at the end of March, has become emphasised during the month of April. Notwithstanding this the orders presently being executed have been hindered and made less profitable to the contractors through almost continuous labour disputes with workmen. Beginning with fitters' helpers or labourers, who struck in many yards for an advance in their wages from their employers—the fitters, the trouble has spread among the riveters, and at the present writing a very large army of riveters are on strike in the Greenock and Port Glasgow districts for an advance in their rates, which the builders are not at all likely to concede. In the east coast yards as well—at Dundee and Grangemouth—labour disputes are rife.

About the middle of April it was reported that a very important shipbuilding contract was in the market, and being keenly competed for by the leading firms on the Clyde, as elsewhere. Barrow is thought to be the stiffest competitor that the Clyde will have. The contract is for several steamers, which are wanted for the development of the trade between the Argentine Republic and this country. In all, it is said, thirteen steamers are required, aggregating 50,000 tons. Other four steamers of smaller build are asked for—in both cases by the one firm—whose headquarters are at Liverpool.

It is subject for regret on the Clyde that not one of the large engine contracts for the Admiralty have come to the river. There are still one or two small contracts to place by the Admiralty, but they are likely to be kept in the south also. Several engine contracts have been booked by Clyde engineers for steamers being built elsewhere, one being a set of engines of about 2,000 H.P., ordered from Messrs. Dunsmuir & Jackson, of Govan, by Messrs. Workman & Clark, of Belfast, for a steamer they are building for an Irish company. Messrs. Dunsmuir & Jackson have just completed a fine set of powerful engines for a vessel of about 3,000 tons, on the eve of being launched by Messrs. Russell & Co., Port Glasgow, and are otherwise pretty fully occupied. Messrs. Hutson & Corbett, of Kilvinhaugh, are excessively busy with new sets of engines, and with conversions.

Such a gratifying state of matters, however, does not obtain generally throughout the engine shops and shipyards of the Clyde. The fresh orders are comparatively few, and it is feared that when the vessels and engines presently under way will have been completed it will be found that there are no new orders to occupy the vacancies thus caused.

As an instance of the rapidity with which new vessels are being produced it may be stated that at the end of last month no fewer than five vessels, with an aggregate of 8,500 tons, were simultaneously fitting out in the harbour of Glasgow. The vessels were the *Saiko Maru*, 2,800 tons, built by the London and Glasgow Shipbuilding Company (Limited), Govan, for a Japanese firm; *Algonquin*, 1,800 tons, by Messrs. Napier, Shanks, & Bell, Yoker, for the Canadian Lakes Service; *Virginia*, 1,800 tons, by Messrs. Russell & Co., Port Glasgow, for a London shipowner; *Domira*, 1,300 tons, by Messrs. Alexander Stephen & Sons, Linthouse, for Messrs. Maclay & M'Intyre, Glasgow; and the *Bio-Bio*, 750 tons, by Messrs. Robert Napier & Sons, Govan, for a South American company.

At the end of March, Messrs. Simons & Co., Renfrew, received an order for one of their patent hopper dredges for harbour improvements in the East. Messrs. Wm. Swan & Co., Maryhill, Glasgow, received in the early part of the month an order for a small screw steamer for passenger and light goods traffic in the West Indies. The vessel is to be fitted with triple-expansion engines by Messrs. Fisher & Co., Paisley, to attain a high rate of speed, and to have all the latest improvements for vessels of this class.

The Ardrossan Shipbuilding Company have laid the keel of a three-masted yacht, which will be of the very best steel. Messrs.

D. Macgill & Co., of Irvine, have secured a contract to build a steel screw steamer for the foreign trade. The order is from Messrs. Ross & Duncan, engineers, Govan, who will supply the engines.

Messrs. James & George Thomson have had their wet dock completed at Clydebank. Operations were started in July last, and since that time 200 men have been employed excavating night and day. The dock is at present accommodating the *City of New York*, the magnificent new Inman liner, which is having her engines and boilers put on board.

At Dumbarton matters have not materially changed since last month, Messrs. Denny being still "over head and ears" with their large Spanish contract, and busy putting the finishing touches to the important new Channel "flyer" for service between Dover and Ostend. Messrs. Birrell, Stenhouse & Co., of Dumbarton, who suspended operations on the 27th of last month, resumed work about a fortnight ago. The cause of the suspension was owing to the fact that a prominent firm of underwriters in Glasgow, with whom the Dumbarton firm were connected in business, were forced to suspend payment. The firm has on hand an iron sailing ship of about 2,000 tons, which is now nearly in frame. Messrs. A. McMillem & Son, of the same town, have secured an order for a small steamer for foreign owners.

All the yards in the Port Glasgow and Greenock district still remain busy. The only order received is for a steel screw steamer of 800 tons, Messrs. Scott & Co. being the contractors. The vessel is for trading on the South American coast, principally with the Argentine Republic, and will be supplied by the builders with engines of 120 H.P. The riveters in both Messrs. Caird & Co.'s and Messrs. Russell & Co.'s yards, numbering over 200 men, struck work for an advance in wages on the 9th inst. This strike, which still continues, is likely to last for some time longer, as the workmen's society is supporting them in their contentions. Messrs. Russell & Co., besides having several steamers in the fitting-out stage, have still on the stocks of their combined establishments nine vessels, five steamers and four sailing ships, one of the latter being about 3,000 tons, the largest sailing ship ever constructed.

Several of the Clyde river steamers have undergone considerable alteration during the past winter, while several new boats have been added to the already numerous fleet. Amongst the latter we may mention the new steamer for the North British Railway Co., which is expected to be very fast; and the *Fusilier*, lately launched for Mr. David Macbrayne. The *Fusilier* will make the twenty-eighth steamer to be employed by this well-known firm in their service to the West Highlands. The Loch Lomond Steamboat Company are also about to place the order for a new steamer for their tourist traffic on the queen of Scottish lakes. She will be a very handsome vessel, and the largest and swiftest yet on the lake. The company have taken advantage of all the latest improvements, both as respects structure and engines, but whether they will have her built in pieces, or, following the usual course, have her constructed at Dumbarton, has not transpired. The steamers at present on that loch are of the flat-bottom type, and cannot, by reason of their having to be towed up the river Leven, and under several bridges, be greater than a certain size.

Messrs. J. Duthie & Son, shipbuilders, Aberdeen, have received an order from Mr. W. T. Moffat, shipowner, Aberdeen, to build an iron screw steamer with a carrying capacity of 250 tons deadweight. The vessel, which is intended for the coal trade, will be 128 ft. long, 20 ft. broad, with 10 ft. depth of hold, and fitted with compound engines of 250 H.P.

The National Lifeboat Institution has recently sent a new lifeboat to Anstruther to take the place of one stationed there many years since. The new boat is 34 ft. long, 8 ft. wide, and rows ten oars, double banked. It was built by Messrs. Woolfe & Son, of Shadwell, London, and possesses all the latest improvements, including the water-ballast fittings, and all the other characteristics of the boats of the National Institution in the way of self-righting, self-ejecting water, &c.; it is provided with a new transporting and launching carriage. The cost of the new boat, carriage, and equipment has been defrayed by Mrs. Atherton Howard, of Cheltenham, in memory of her late husband, Colonel Atherton Howard, and in accordance with her wishes the lifeboat is named the *Royal Stuart*.

Natal Harbour Works.—Cathcart W. Methven, Esq., at present engineer-in-chief to the Greenock Harbour Trust, has been appointed resident engineer on the Natal harbour works.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—The departure of *H.M.S. Victoria* from the Elswick yard, an event which took place on April 7th, has caused greatly increased depression at that establishment, the work remaining to be executed being inconsiderable. For more than a year this latest and most important addition to the list of Tyne shipbuilding concerns has shown abnormal slackness, and up to the present no signs have appeared that would indicate the early approach of a brisker time. The state of business at Messrs. Armstrong, Mitchell & Co.'s Low Walker yard offers a remarkable contrast to the condition of affairs at their Elswick establishment, as there are now no less than six berths occupied, most of them with vessels of unusually large proportions. Hands are being taken on in all departments, and quite exceptional activity is likely to exist in the yard during the remainder of the year. At the adjoining yard, belonging to Messrs. W. Dobson & Co., preparations are being made to put down a much larger vessel than has yet been built by the firm, and the future outlook in this case is also very promising. Messrs. Wood & Skinner have put down a second keel since last month, and as the supplies of material are now more plentiful, the contracts in hand are being pushed on with greater vigour. The large vessel, *Alfonso XII.*, which was sold by Messrs. W. Richardson & Co. to a Spanish trading firm a few weeks ago, is now nearly ready for sea, the last item of equipment, namely, the *suite* of thirteen teak-built boats manufactured by Messrs. M. Robson & Sons, Monkwearmouth, being about ready for delivery. Messrs. Richardson have four vessels on the stocks, but one is so far advanced in building that the berth occupied will very shortly be vacated. Messrs. Swan & Hunter have just laid the keel for a fifth vessel, and the work of frame turning is continued night and day. At Messrs. Hawthorn & Leslie's yard full activity exists. The firm are now busily fitting out the last of the handsome fast passenger steamers recently launched from their establishment, and intended for the China trade. Messrs. R. Stephenson & Co. are making fair progress with the three merchant steamers that are on their stocks, two of which are for Liverpool, and one for Hull. The firm have other vessels of a similar class to lay down, and they have also in progress two composite light-ships, ordered by the Trinity-House. By the reopening of their Howden yard, an event which was noticed in last month's report, Messrs. Palmer have provided themselves with fifteen building berths, and, judging by present appearances, they will all pretty soon be occupied, as keels are being put down with almost unprecedented quickness. The Tyne Shipbuilding Company have seldom been so busy as at present, the whole of their berths being occupied with vessels of superior type and large tonnage. Both in this case and at Messrs. Palmer's the frameturners are working double shift. The whole of the graving docks on the river are occupied with vessels undergoing repair, and Messrs. Edwards have, in addition, a large steamer being extensively altered beside their shipbuilding yard at Howden. In marine engineering the activity noted for several months past is fully maintained, and night work is still the rule in every instance. Messrs. Clark, Chapman, & Parsons, of the Victoria Works, have obtained a great many orders for steam winches and windlasses, and their establishment, which is the largest in the north of England devoted to this special kind of work, is now very nearly employed to its full capacity. Messrs. Emmerson, Walker, & Thompson Brothers have also succeeded in getting a large proportion of the work that was lately in the market, and are consequently able to keep their machines in continuous operation. Messrs. Abbot & Co., Gateshead, have in hand some important colonial orders for hydraulic machinery, and they have more marine engine work in their foundry than at any period within the past three or four years. In the anchor department the firm are busy with the manufacture of Tyzack's patent anchor, a great many orders for which have lately been obtained. Owing to the existence of a wages dispute, however, their chain-making department is at present inoperative. The engineering and bridge building departments of Messrs. Hauks, Crawshay & Sons are just now very quiet, the contracts in course of execution being comparatively unimportant. In their rolling mills and steel works, however, business is active, and likely to continue so. The manufacturers of iron and steel sheets have an abundance of work, and prices for these classes of goods remain very firm. Messrs. Spencer & Son, of the Newburn Steel Works, keep very busy on orders for crank shafts, stern frames, rudders, anchors, and other specialities connected with shipbuilding and engineering. At the Elswick Steel Works of Messrs. Armstrong,

Mitchell & Co. there is also considerable activity, but a different state of things exists in the ordnance department of that great firm, and discharges of hands from the different shops are taking place weekly. Among rope manufacturing establishments, those of Messrs. Dixon & Corbett and R. S. Newal & Co., Gateshead, may be mentioned as particularly well supplied with orders. The manufacturers of protective compositions for ships' bottoms are having their productive resources pretty fully utilised, and makers of boiler covering cements are also busy. The Mica Lubricant Company, South Shields, continues to receive orders from all parts of the country, as well as from abroad, for supplies of their speciality, and their weekly output of the commodity is steadily increasing.

The Wear.—As illustrating the difference between the state of matters now and twelve months ago in the Wear shipbuilding trade, it may be stated that for some time past there has been a positive scarcity of certain classes of labour in the shipyards. It has been found especially difficult to obtain a sufficient supply of unskilled labour in the plating departments, and wages have, in consequence, been slightly advanced. While on the subject of wages, it may also be mentioned that an advance of 1s. 6d. per week has been conceded to the operatives in the boiler shops. Mr. James Laing, of the Deptford yard, has obtained from the British India Steam Navigation Company an order for a first-class steamer, to be over 400 ft. in length, and of corresponding proportions in other respects. It may be remembered (the announcement was made in last month's report) that the shipping company above mentioned have become the owners of the large vessel *Trans-Pacific* built by Messrs. Doxford, and described by an eminent authority as the finest specimen of a cargo vessel in existence. Mr. Laing has several other orders of importance to deal with during the next few months, and a second frame furnace has just been put in operation. Messrs. Short Brothers and Messrs. Doxford have each a large number of orders, and Messrs. Pickersgill have as many contracts as serve to keep the operatives in full employment. As stated in last month's notes, Messrs. R. Thompson & Sons have obtained an order for a second vessel, but it is not so large as the one now on the stocks which, it may be stated, will shortly be ready for launching. This firm have docked several vessels for repairs during the month, and are still pretty busy in that department. The Strand Shipbuilding Company have obtained the contract to lengthen the Wear dredger *Titan*, and have also taken in hand the work of extensively repairing the steamer *Achilles*, belonging to Messrs. Tyzack & Branfoot, Sunderland. The steamer *Rhodora*, of London, upon which an explosion of gas recently took place, blowing up the main hatch and inflicting serious damage in other respects, is to be repaired in the Cornhill dock, and the steamer *Vindaballo* is now undergoing the necessary alterations of structure to fit her for the safe and economical carrying of oil in bulk. Messrs. J. L. Thompson & Sons have been commissioned to build a sister ship to the *Pius IX.*, built about one year ago by Messrs. Boolds and Sharer. The North Sands yard is still quite full of work, and the platers are required to work overtime nightly. Messrs. Bartram & Haswell, Messrs. Austin, and Messrs. Blomer, have each two vessels in progress, and the Sunderland Shipbuilding Company have five berths occupied. The Marine Engineering trade continues to be extremely active, and the greater part of the machinery in all the establishments is kept going night and day. The North Eastern Engineering Company have an important contract for pumping machinery in addition to a score or so of orders for marine engines. Mr. John Dickinson has forwarded to the Glasgow Exhibition his patent crank shaft, which attracted so much attention at the Newcastle Show last year. Mr. A. A. Rickeby has just forwarded a number of powerful steam winches to an important Tyne shipbuilding firm, and as he has other orders for the same description of deck accessory, besides orders for piston rod packing, &c., his establishment is kept very busy. Messrs. C. & M. Douglas have contracts in hand for repairs to machinery in local manufacturing concerns, and the proprietors of the Pier Engine Works are engaged in fitting up a new boiler for the Ayres Quay Bottle Company. In both iron and brass foundries exceptional briskness is still the rule, and with one exception the forges in the district are in full operation. A new fitting shop is being erected in connection with the Pallion Forge, recently taken over by Messrs. J. L.Thompson & Sons. Orders for Bell & Rockliff's patent bulwark rails and hatch cleats are coming to hand very rapidly, and some have come from Continental shipbuilding firms. Specimens of these useful specialities have just been sent to the Glasgow Exhibition.

The Hartlepools.—Shipbuilders at this centre have booked new orders during the month, and briskness at all the yards is maintained. Besides the new work, there are some heavy repair contracts in hand. Mr. Gray's new yard is almost ready for the commencement of operations, and the keel for the first vessel will very shortly be put down.

The Tees.—Shipbuilding at Middlesbro' and Stockton keeps very active, and at most of the yards new keels are being placed whenever vessels are launched. Messrs. Blair & Co.'s engineering works are exceedingly busy, and the establishment of Messrs. Westgarth & English is also well employed. Messrs. Riley Brothers of the Perseverance Boiler Works, Stockton, have more orders for the different descriptions of boilers manufactured by them, than they have ever before had to deal with. Their works are exceedingly busy, and extensions are contemplated as soon as arrangements can be made to carry them out.

THE MERSEY.

SHIPBUILDING on the Mersey is almost a speciality, the regular cargo boat hardly ever owes its birth to the river which it is probably destined to visit frequently during the course of its existence. Indeed, one of our local builders has apparently so far despaired of this class of business, that he has commenced building steamers of the tramp "genus" on his own account. Messrs. Roydeo, of Queen's Dock, Liverpool, have just completed a large steamer for the general trade, which is to be worked by Messrs. MacVicar, Marshall & Co., of Liverpool, as managers for a company that is practically comprised of the Royden family. Messrs. Royden are likewise building another steamer to be employed also under the same management. They have in addition one or two sailing ships on the stocks, but the fact that they are building on their own account certainly indicates a scarcity of orders. Laird Brothers have several large repair jobs in hand, but the principal work they have in their yard is a large screw steamer for hot climates, fitted with awning decks, punkahs, and every requisite for hot weather. The other shipbuilding yards are quite inactive, and orders are eagerly inquired for. Messrs. A. Rutherford & Co. have secured a small order for 10 steam launches for the River Plate, but there is quite a dearth of other business.

Freights for some time past have ruled very good for outward business, whilst homeward freights, chiefly from India, after being low and stagnant, have improved considerably, and for the first time for months past Bombay homeward freights have passed the apparently insuperable barrier of 20s. Perhaps Messrs. Roydens, with their new boats, may have foreseen this improvement, in which we know they have participated. Black Sea freights have been exceedingly buoyant, and prompt steamers have secured freights that have not been current for many years. The market, though not quite up to its best, is still firm, and as the steamers become more prompt, they fetch more money in the market. Altogether the outlook is satisfactory, and if shipowners will only abstain from their ruinous and pernicious habit of fixing ahead, we think we will see a fair run of freights, which will not only encourage present shipowners, but will probably give a fresh impetus to shipbuilding.

CARDIFF.—Steam coal has again shown a good deal of activity. There has been a good demand for special descriptions at 9s. to 9s. 3d. per ton, while best bunker coal has made 8s. 6d. and good dry coal 8s. 3d. per ton. Patent fuel has shown some signs of improvement. Welsh coke has been firm at former rates. The demand for most descriptions of iron and steel has been quiet, but the local works are pretty well employed upon o'd contracts. Heavy section steel rails have made £3 17s. 6d. to £4 2s. 6d. per ton, and light section steel rails £4 7s. 6d. to £4 15s. per ton.

THE GREAT EASTERN RAILWAY COMPANY have ordered from Earle's Shipbuilding Company, of Hull, a new steamer for their Continental service. This vessel will be a sister ship to the *Cambridge* (s), which is a favourite boat on the Harwich-Antwerp route. She will be 280 ft. long, 31 ft. beam, with a set of twin screw engines, calculated to indicate 2,200 H.P. The saloons will be placed forward of the engines, as in Atlantic liners, and will be fitted with electric light and a special system of ventilation.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—ENGLISH.

Alphonso XII.—On March 20th there was launched from the yard of Messrs. Wigham Richardson & Co., at Low Walker, the largest merchant steamer yet built on the Tyne. The vessel is constructed of steel, with double cellular bottom, and is intended for the Spanish mail service. She has the old clipper bow, which, it is stated, is again coming into fashion. Alike by reason of size, power of engines, and magnificence of internal fittings, she is, as well as the largest, one of the most splendid steamers ever built on the Tyne. The following are the official particulars of the *Alphonso XII.*:—Length over all, 426 ft.; length between perpendiculars, 393 ft.; beam moulded, 47½ ft.; depth moulded, 36 ft. To be classed either at Lloyd's or with the Veritas of the highest character, and built of Siemens-Martin steel. The bottom is cellular and double. There are three iron decks all sheathed, the upper with teak, and an orlop deck below. Her gross tonnage will be over 5,000 tons, and her engines will indicate 4,500 horses, capable of driving her from 15 to 16 knots an hour. She is intended for the mail service between Spain and the Antilles, and is fitted with every imaginable luxury for 240 passengers and 800 emigrants, besides the ship's company of nearly 150, comprising commander, officers, chaplain, doctors, pursers, Post Office officials, engineers, crew, and firemen, and a small army of cooks and stewards. The engines and boilers are of the builders' own make. The engines stand 32 ft. high in the erecting shops. The boilers are of steel, and will be fitted to work with forced draught if so required. The decks are arranged to mount guns in case of need. All the unloading and loading, as well as the steering, will be noiseless, being effected by hydraulic gear. The lighting throughout will be by electricity. She will be available in case of war as an armed cruiser. Although her speed, with natural draught, will be from 15 to 16 knots, she will be capable, with forced draught, of developing a still higher rate of progression. There was a large attendance at the launch, including Mr. Wigham Richardson, Sir B. C. Browne; Mr. Hunter, postmaster of Newcastle; Mr Roberts, clerk to the Newcastle magistrates; Principal Garnett, Captain Romler, Mr. Strangeways, the Rev. H. S. Hicks; Mr. John Wait, J.P., North Shields; Councillor Cottew, North Shields; Captain José San Pedro, commander of the new vessel; and many others. The ceremony of christening the steamer was performed by the twin daughters of Captain San Pedro, each of whom broke a bottle of champagne, enveloped in the Spanish colours, against the stem of the vessel as she commenced to glide down the ways. The launch was very successful. The vessel is owned by the Compania Transatlantica.

Candia.—On March 24th Messrs. Wm. Dobson & Co. launched from their shipbuilding yard at Low Walker an iron screw steamer, of 2,000 tons burthen, for Newport owners. The vessel is constructed for the general carrying trade, and will be fitted with triple-expansion engines by Messrs. Black, Hawthorn & Co., of Gateshead. Patent combination windlass fitted by Emerson Walker & Thompson Bros., Limited. On leaving the ways the vessel was named the *Candia* by Miss Flora Stephens, of Newcastle.

Chanzy.—On March 26th there was launched from the yard of the Sunderland Shipbuilding Company, Limited, a steel screw steamer built to the order of French owners. The dimensions of the steamer are:—Length between perpendiculars, 190 ft.; breadth, 30 ft.; depth of hold, 14 ft. The vessel is classed 100 A1 at Lloyd's, under special survey, and is built with a long raised quarter deck, short bridge, under which there is accommodation for captain and officers, and topgallant forecastle for crew, triple compound engines by the North Eastern Marine Engineering Company, Limited, having cylinders 16 in., 26 in., and 43 in. by 30 in. stroke, 150 lbs. working pressure. The vessel has been specially designed to carry a large cargo upon an exceedingly small net register tonnage, and will be employed in the coal trade between Wales and Caen. Upon leaving the ways the steamer was gracefully named *Chanzy* by Miss Hudson, of Sunderland.

Neptune.—On March 26th Messrs. R. & J. Evans & Co. launched from their shipbuilding yard, Brunswick Dock, Liverpool, a twin-screw steamer for the Mersey Docks and Harbour Board, from model and designs and built under the superintendence of William Glover, Esq., consulting engineer. The vessel was taken to the Sandon Dock, where she will be fitted, by Messrs. D. Rollo and Sons, with powerful machinery of the most approved form for towing purposes, and also with Messrs. Merryweather & Sons' steam fire-engine, capable of pumping 750 gallons of water per minute, and throwing a jet 190 ft. high. Patent hand-power windlass by Emerson Walker & Co. The vessel was named the *Neptune* by Mrs. Liardet.

Falshaw.—On March 27th a steel screw steamer was launched from the premises of Messrs. T. Turnbull & Son, Whitby. The new vessel has been built to the order of Messrs. H. Baxter and Co., Whitby, and was christened *Falshaw* by Mrs. Baxter, wife of the senior partner. The *Falshaw* is a vessel of a deadweight carrying capacity of about 3,350 tons. Her dimensions are:—Length over all, 298 ft.; breadth, 38 ft.; depth on top of floor plate, 38 ft. Her engines are by Messrs. Blair & Co., Stockton, and of 175 H.P. (nominal). Emerson Walker & Co.'s patent combination windlass is fitted on board. She is classed A 1 at Lloyd's.

Romulus.—On March 27th there was successfully launched, complete with steam up, ready for sea, from the shipbuilding and engineering works of Messrs. Oswald, Mordaunt & Co., Southampton, the second of two screw steam fishing vessels, built to the order of F. W. Leybourne Popham, Esq., of Littlecote, Hungerford, Wiltshire. The dimensions are as follows:—Length, 144 ft.; breadth, 22 ft.; depth, 11 ft. 3½ in. The vessel has a long raised quarterdeck, extending past forward engine room bulkhead, turtle-back forecastle, fitted with steam windlass, crane, and breakwater. There is a large deck house forming entrance to saloon and state rooms at fore end of quarterdeck. Accommodation for captain, officer, and engineers is provided under quarterdeck aft, crew being berthed in sunk forecastle. Vessel is ketch-rigged, and classed at Lloyd's 100 A1. After the launch vessel steamed away on her trial trip. The engines, by the same firm, are of triple-expansion type. Cylinders 12½ in., 19 in., and 31½ in. diameter, with a stroke of 24 in., Joy's patent valve gear fitted to each cylinder. Large steel boiler constructed for working pressure of 158 lbs. per square inch. On trial the engines worked smoothly and without trouble, propelling vessel at a high rate of speed. The vessel, on leaving the ways, was gracefully christened the *Romulus* by Miss Popham.

Julio.—On March 27th there was successfully launched from the yard of Messrs. William Doxford & Sons, Pallion, the fine new screw steamer *Julio*, built for the Compania Bilbaina de Navegacion, Bilbao; directors, Messrs. Agnar and Astigaraga. On leaving the ways she was gracefully christened by Miss Spencer, Newcastle. In performing the ceremony, success and prosperity were desired in the words: "Buena suerte y muchos cuarros al *Julio* y la Compania Bilbaina de Navegacion." The *Julio* is built of steel, her dimensions being 275 ft., 36 ft., and 23½ ft. On the spar deck rules with two decks laid, and beams for third deck. The vessel is being prepared for the wine trade. Her engines are triple expansion, 20 in., 33 in., and 52 in., by 36 in. stroke. The vessel will carry 2,800 tons cargo on 19 ft. draft, and is in every way fitted with the most modern arrangements for economical trading. She has been built under the superintendence of Mr. Antonio Uribe, superintendent of the company; the engines have been supervised by Mr. William Baird; and she is fitted with Emerson Walker & Co.'s patent windlass. She will sail under the command of Captain Eguidazu.

Resolution.—On March 28th Messrs. Joseph L. Thompson and Sons successfully launched from their North Sands Shipbuilding Yard a steel steamer of 3,050 tons deadweight. This vessel has been built to the order of Messrs. Rowland & Marwood, of Whitby. The engines, which are of 180 H.P., are being built by Messrs. Thos. Richardson & Sons, of Hartlepool, and are of the triple-expansion type. The vessel was named the *Resolution* by Mrs. Wm. Wright, of Flowergate Cross. The launch was witnessed by a company of co-owners from Whitby. The construction of the *Resolution* has been under the supervision of Capt. R. K. Smith on behalf of the owners.

Orkla.—On March 28th there was launched from the yard of Messrs. S. P. Austin & Son, Wear Dockyard, a screw steamer of the following dimensions:—Length, between perpendiculars, 282 ft.; breadth, 38 ft.; depth, 19 ft. 3 in. She is constructed of Siemens-Martin steel, with full poop, long bridge to fore hatch, full forecastle, iron masts, cellular bottom for water ballast, tonnage about 2,090 tons gross, 1,360 nett. She has been built under special survey for the highest class at Lloyd's, to the order of a Leith firm. She will be fitted with triple-expansion machinery, of 200 H.P. (nominal), by Mr. George Clark, Southwick Engine Works, and Emerson Walker & Thompson Bros.' patent direct steam capstan windlass. As the vessel left the ways she was

named *Orkla* by Miss Austin. During her construction the vessel has been under the inspection of Mr. Crichton, Engineer, R.N., on behalf of the owners. She will be commanded by Captain Sutherland, formerly of the *Tana* (s).

Sapphire.—On March 31st Messrs. Richardson, Duck & Co. launched, from their building yard at South Stockton, an iron screw steamer of the following dimensions:—Length over all, 286 ft.; breadth, extreme, 37 ft. 5 in.; depth of hold, 20 ft.; tonnage, gross, about, 2,100 tons. The vessel, which has been built to the order of Messrs. Christie & Co., of Cardiff, has a raised quarter-deck, long bridge, and topgallant forecastle, and is classed 100 A1 at Lloyd's. She has a double bottom on the cellular principle, in after and main holds, and under engines and boilers, capable of holding 422 tons of water ballast, and is fitted out with four steam winches, steam steering gear, Hingley's patent stockless anchors, and all modern improvements for facilitating the loading, discharging, and manœuvring of the vessel. Patent combination windlass by Emerson Walker & Co. The engines, by Messrs. Thos. Richardson & Sons, of Hartlepool, with cylinders 21½ in., 36 in., and 58 in., by 36 in. stroke, are expected to give her a speed of 9 knots. This is the sixth vessel built by Messrs. Richardson, Duck & Co. for Messrs. Christie. The vessel was named the *Sapphire*, the christening ceremony being performed by Mrs. J. H. Clegg, of Stockton-on-Tees. The *Sapphire* is being completed under the superintendence of Mr. C. A. Bushell, of Newcastle-on-Tyne.

Guy Colin.—On April 3rd Messrs. Raylton, Dixon & Co. launched from the Cleveland Dockyard, Middlesbro', a fine steel screw steamer, named the *Guy Colin*, which has been built to the order of G. E. Bowring, Esq., of London. Her dimensions are:—Length, 300 ft.; breadth, 38 ft. 2 in.; and depth, 20 ft. 6 in., having a deadweight capacity of about 3,350 tons. The engines will be fitted by Messrs. Richardson & Sons, of Hartlepool.

Earl of Dunraven.—On April 3rd there was launched from the building-yard of Mr. J. T. Eltringham, Stone Quay, South Shields, a paddle steamer, the dimensions being: Length, 122 ft; breadth, 20 ft. 3 in; depth, 11 ft. This vessel, which is of the most modern and approved type, will be fitted with a single slide lever surface condensing engine of 98 N.H.P., steam for which is supplied by one large multitubular steel boiler, working at 45 lbs. pressure, the paddle-wheels being on the feathering principle. The vessel, named the *Earl of Dunraven*, has been built to the order of Messrs. J. P. Rennoldson & Sons, of South Shields, who supply the machinery. She is intended for the passenger trade in the Bristol Channel, and has been provided with all the special requirements of the Board of Trade for the comfort and convenience of passengers. *The Earl of Dunraven* is owned by Messrs. Martin & Marquand, of Cardiff.

Rosina.—On April 4th there was launched from the yard of Mr. W. H. Halford, at Gloucester Docks, a screw steam yacht of 61 tons, named the *Rosina*, of the following dimensions, viz: Length over all, 103 ft.; length on water line, 77 ft.; breadth, 13 ft. The engines are of the compound vertical type, with cylinders of 10 in. and 19 in. in diameter, with a stroke of 16 in., and 140 H.P.N. Her steel boiler works to 90 lbs. pressure. Engines and boiler were supplied by Messrs. J. J. Seekings and Co., of Gloucester.

Luath.—On April 10th there was launched from the shipyard of W. S. Cumming, Blackhill Dock, Glasgow, a steel screw yacht of the following dimensions:—60 ft. by 11 ft. by 9 ft. 6 in., moulded. This vessel has been built to the order of Mr. John Henry, Dowanhill, Glasgow, and has been classed 100 A 1 at Lloyd's, special survey. With the exception of the deck, which is of selected yellow pine, all the deck fittings are of teak, and all ironwork galvanised. In the forward part of the vessel there is a large saloon. The crew is berthed forward in a forecastle fitted with four berths, with seats, lockers, &c., as usual, and the cooking stove of the vessel is also fitted here. The vessel has one light pole mast, schooner-rigged, and complete fit, in every way ready for service. The engines, which are being supplied by Messrs. Muir & Houston, are of the compound surface-condensing type, working at a pressure of 120 lbs. per square inch. The vessel, as she left the ways, was named the *Luath* by Mrs. William Johnstone, Partick.

Pheasant.—On April 10th this screw composite gunboat of the first class was launched at Devonport Dockyard. Her machinery, which she has yet to ship, has, for the first time, been made in the factory at Keyham, the officials of which competed against outside firms and secured the contract. The ship will be propelled by a single screw. Her coal-carrying capacity will be 105 tons, and, when fully equipped, she is expected to attain a speed of 13·25 knots under forced draught, with a total indicated horse-power of 1,200. The *Pheasant's* armament will comprise six 4-inch guns, and four Nordenfelts mounted under the poop. She is to be completed by the end of September.

Rouen.—On April 12th the Fairfield Shipbuilding and Engineering Company, Limited, launched from their yard at Fairfield the steel paddle steamer *Rouen*, one of two vessels being constructed by that firm for the London, Brighton, and South Coast Railway Company for their express service between Newhaven and Dieppe. The principal dimensions of the *Rouen* are as follows:—Length, 250 ft.; breadth, 29 ft.; depth (moulded), 15 ft.; tonnage, 800 tons. The vessel will be fitted up for 110 first-class and 108 second-class passengers, with every convenience necessary for the Channel service, including electric lighting, electric bells, steam heating-pipes in saloon cabins, &c. The ventilation has also been specially studied, and the vessel will be fitted with the usual steam apparatus for steering, lifting anchor, pumping, &c. A large promenade deck, extending over the engines and boilers between the paddle-boxes, and extending over the deckhouse aft, will be fitted for the use of first-class passengers. Accommodation will be provided for second-class passengers forward on the 'tween decks, and for the steerage passengers forward under the turtle backs. A full complement of lifeboats, &c., will be fitted, besides a number of patent collapsable boats, thus providing ample capacity for the whole of the passengers. The vessel will be fitted by the builders with a set of compound diagonal and surface-condensing engines, with cylinders 46 in. and 83 in. diameter by 6 ft. stroke, the steam being supplied by four single-ended multitubular boilers, each with three corrugated furnaces constructed of steel, for a working pressure of 110 lbs. per square inch. As the steamer left the ways she was named by Mrs. Sarle, wife of the general manager of the London, Brighton, and South Coast Railway Company.

Benmore.—On April 12th Messrs. Dobson & Co. launched a steamer from their yard at Low Walker, built to the order of the Grampion Steamship Company (Limited), of Aberdeen, of the following dimensions:—Length, 255 ft.; breadth, 34 ft. 6 in.; depth, 17 ft. 6 in. She is to be fitted with engines of the triple-expansion type, with every modern improvement, built by the North-Eastern Marine Engineering Company (Limited). Fitted with Emerson Walker & Thompson Bros.', Limited, patent combination windlass. The vessel is built of steel. As she left the ways she was named the *Benmore* by Miss Lottie Adam, youngest daughter of Mr. H. B. Adam, one of the managers.

Harperly.—On April 12th there was launched from the shipbuilding yard of Messrs. John Readhead & Co., West Docks, South Shields, a steel screw steamer, having the following dimensions, viz.:—300 ft. by 39 ft. by 20 ft., having a deadweight capacity of 3,350 tons, and to be classed 100 A 1 at Lloyd's, special survey. The vessel is of the improved well-decked type, having long raised quarterdeck, bridge amidships, and topgallant forecastle, and is built on the cellular bottom principle for water ballast. She will be fitted with triple-expansion engines of 250 H.P.N., working at a pressure of 160 lbs. per square inch, and combining all modern improvements. The engines and boilers are being built by Messrs. J. Readhead & Co. The steamer is being built to the order of William Wright, Esq., of South Shields and London, under the superintendence of Captain G. W. Freeman. The vessel is named the *Harperly*, and is to be registered at London. The ceremony of christening was performed by Miss Edith Wright.

Harrow.—On April 12th Messrs. W. Gray & Co., West Hartlepool, launched a fine steel screw steamer, which has been built to the order of Messrs. Galbraith, Pembroke & Co., London. The dimensions of the vessel are:—Length over all, 310 ft.; breadth, 38 ft. 6 in.; depth, 23 ft. 3 in. She will take Lloyd's highest class, and carry over 3,800 tons deadweight. The design of this vessel embraces the latest improvements in the best type of cargo steamers. A long bridge of extra strength, starting at the after end of the engine space, is carried over the midship part of the vessel right up to forehatch. A long raised quarterdeck joins the bridge and poop decks; the latter contains the saloon and cabins for officers, while accommodation is provided for engineers at the after end of the bridge, and for the crew at the forward end of the same. A topgallant forecastle gives protection forward, and underneath it is placed a direct steam capstan windlass, made by Messrs. Emerson, Walker & Co. The sides of

the vessel being constructed on the web-frame principle, beams in the holds are dispensed with, and a large clear space is provided for working cargo of the most bulky description, which can readily be taken in through the ample hatchways provided. Four steam winches, steam steering gear, and two donkey boilers are fitted, and double bottom for water ballast under each hold. The vessel will in every respect be well equipped for general trading. The engines, which are on the triple-expansion principle, are being supplied by the Central Marine Engineering Co., of West Hartlepool. They are of 1,100 H.P., with steel boilers to work at 160 lbs. pressure, and give an ample supply of steam. The christening ceremony was gracefully performed by the Mayoress of West Hartlepool, the vessel being named *Harrow*. The vessel and her machinery are being superintended by Captain Page and Mr. T. O. Charteis, respectively, on behalf of the owners.

Sarah Ann.—On April 12th, at the yard of Mr. Thomas Brown, Mushroom, a wooden screw steamer was launched. The vessel, which is intended for the coasting trade, is 90 ft. long by 20 ft. by 9 ft., and on leaving the ways was christened the *Sarah Ann* by Miss Ann Isabella Brown. The vessel has a very light draught, and is well adapted to enter ports where there is shallow water.

Lowlands.—On April 13th Messrs. W. Gray & Co. launched a fine steel screw steamer of the following dimensions:—270 ft. length overall, 36 ft. 6 in. beam, 19 ft. 5 in. depth, and of 2,500 tons deadweight capacity, built to the order of Messrs. Hardy, Wilson & Co., West Hartlepool, and to class 100 A1 at Lloyd's. The vessel is of the well-decked type, with a long raised quarter-deck, having saloon and cabins for officers and a few passengers aft. A long bridge of extra strength, carried right up to fore hatch, and containing comfortable quarters for the crew. The usual topgallant forecastle is fitted forward with Emerson, Walker & Co.'s windlass. The hull is built on the web frame principle, dispensing with hold beams, and giving a clear hold for working cargo. Five hatches are fitted, four steam winches, steam steering gear, donkey boiler, and double bottom under each hold for water ballast. The boats are carried on beams overhead, and a complete equipment provided for general trading. Fine triple-expansion engines, having cylinders 19 in., 30½ in., and 51 in. diameter, with a 36 in. stroke of piston, giving 700 H.P., and two steel boilers to work at 150 lbs. pressure per square inch are being supplied by the Central Marine Engineering Company, West Hartlepool. The vessel and her machinery have been superintended during construction by Mr. J. Maddeson, on behalf of the owners. She was gracefully christened *Lowlands* by Miss Edith Wilson, West Hartlepool, daughter of one of the managing owners. It may be added that the *Lowlands* is the eighth steamer built by Messrs. W. Gray & Co. for Messrs. Hardy, Wilson & Co.'s fleet.

Tudor Prince.—On April 13th there was launched from the yard of J. T. Eltringham, Stone Quay, South Shields, an iron screw trawler named the *Tudor Prince*. This vessel, which has been built to the order of Messrs. W. H. Storey & Co., North Shields, is of the following dimensions:—Length, 85 ft.; breadth, 17 ft.; depth, 9 ft. 3 in. The engines (compound surface condensing, of 30 N.H.P.) will be fitted by Messrs. Baird and Barnsley, North Shields, and include all the latest improvements.

Cairnryan.—On April 14th there was launched from Palmer's shipbuilding yard at Jarrow, a steel screw steamer of the following dimensions:—Length between perpendiculars, 260 ft.; breadth, moulded, 36 ft.; depth, 18 ft. 9 in. The vessel is to take the highest class at Lloyd's under special survey; her deadweight carrying capacity, 2,500 tons. She will be rigged as a three-masted schooner and have a long, raised quarter-deck from the after end of the bridge joining the sunk poop, in which will be the cabins where the captain and officers will be located. There will be also a bridge-house amidships extending forward to about the foremast, engineers' berths being arranged at the after end, and accommodation for crew and firemen at the fore end, and a topgallant forecastle. Four water-tight steel bulkheads and iron shifting boards have been fitted in the holds. The vessel is constructed with cellular bottom, for water ballast, all fore and aft. Tyzack's patent stockless anchor, steam steering gear, winches, and everything necessary for a first-class cargo boat are provided. The engines will be triple expansion, also by the Palmer Company, having cylinders 18½, 31, and 51 in. respectively, and a stroke of 30 in., steam being supplied from two single-ended boilers, 11 ft. 4½ in. and 10 ft. 3 in., at a working pressure of 160 lbs. The steamer, which has been built to the order of Messrs. E. & D. Cairns, of Leith, was christened the *Cairnryan* by Mrs. Cairns.

Yanara.—On April 19th there was launched from the shipbuilding-yard of David and William Henderson & Co., a composite racing yacht of 60 tons rating, built to the order of Mr. Paul Ralli, London, from the designs of G. L. Watson. On leaving the ways she was named *Yanara* by Sir John Corbett, K.C.B. She will be commanded by Captain William Cranfield, and is intended to compete at the various regattas during the season.

Grenville.—On Monday, April 23rd, Messrs. Edward Withy and Co. launched from their yard at Hartlepool a steel screw steamer, built to the order of Messrs. J. Holman & Sons, London. The dimensions of the vessel are 260 ft. by 35 ft. by 18 ft., and she is built throughout of Siemens-Martin steel. The vessel has a long raised quarterdeck, long bridge house, and a topgallant forecastle. The main bridge, quarter, and topgallant decks, skylights, bulwarks, rails, bulkheads, cargo battens, &c., are built of steel and iron. The ship is constructed with a cellular double bottom (Withy & Sivewright's patent), all fore and aft, and is fitted with four steam winches, two donkey boilers, and patent windlass fitted on forecastle, hand and steam steering gear amidships, and patent screw standby gear aft. The accommodation for officers and passengers is under the poop aft, and is fittod up in hardwood. The panels in the sides of the saloon are handsomely painted in oils by the lady decorative staff of the firm, and considerable taste has been shown in the selection of the different subjects painted. The accommodation for the engineers is fitted up in a neat and comfortable style in the bridge, and the crew and firemen are berthed under the topgallant forecastle. The steamer is rigged as a two-masted fore and aft schooner, with iron lower masts, and is built to the 100 A1 class at Lloyd's under the personal superintendence of Captain Holman. She will be fitted with triple-expansion engines by Messrs. Blair & Co., Stockton-on-Tees, under the superintendence of E. J. Caiger, Esq. On leaving the ways the ship was gracefully christened *Grenville* by Mrs. Frank Holman, wife of one of the owners.

Hereward.—On April 23rd a large and powerful steam tug was successfully launched from the shipbuilding yard of Messrs. Cook, Welton & Gemmell, South Bridge Road, Hull. She has been built for Messrs. T. Gray & Co., Limited, of Hull, who have placed the contract for the ship and engines in the hands of Messrs. Charles D. Holmes & Co., engineers, &c., English Street, which firm has entrusted the construction of the hull to the above-mentioned firm of shipbuilders. When the vessel is complete she will be the fastest and most powerful tug on the Humber. Triple-expansion engines of the most approved design and construction, and a large boiler having a working pressure of 150 lbs. per square inch, will be placed on board by Messrs. Charles D. Holmes & Co. As the vessel left the ways she was gracefully christened the *Hereward* by Miss A. A. Tully. A very large company assembled at the yard, the ladies and gentlemen present including all three partners in the shipbuilding firm of Messrs. Cook, Welton & Gemmell, Mrs. and Miss Welton, Miss Gemmell, Mr. W. H. Tully, Mr. John and Mrs. Gray, Mr. G. Gray, Mr. Joseph and Mrs. Gray, Mr. Robert Gray, Miss Gray and Miss M. Gray, Mr. J. R. Smith, and Mr. J. H. Leetham, &c. The launch was extremely successful, the *Hereward* taking the water in magnificent style. As soon as the cheers which greeted the successful floating of the vessel had subsided, the principal ladies and gentlemen present made a move for the carpenters' shop, where light refreshments were served. Several toasts were proposed, including "Success to the *Hereward*," "Prosperity to the Builders," "Messrs. T. Gray & Co., Limited," "Messrs. C. D. Holmes & Co.," and the health of Miss A. A. Tully, who christened the ship. In responding to the toast of "Messrs. T. Gray & Co.," Mr. George Gray, in the course of an eloquent speech, stated that the *Hereward* would not only be the most powerful tug upon the Humber, but would be able to compete with any of the famous tugs which came to Hull to tow the big ships for long distances. The *Hereward* is 103 ft. long, 20½ ft. broad, 11 ft. deep, and of 110 tons register. She is an iron screw vessel, is classed 100 A 1 at Lloyd's, and will steam 14 miles per hour. She is fitted with every latest improvement, and will be able to successfully accomplish the lengthiest and most difficult towing operations.

Yang.—There has been lately launched from the Low Walker shipbuilding yard of Sir W. G. Armstrong, Mitchell & Co. a steel twin-screw steamer, for service on the Caspian Sea. The

vessel, which is named the *Yang*, is of 500 tons burthen, and 180 ft. long, and on her arrival at St. Petersburg will be divided, so as to pass the canal locks. A portion of the holds of the *Yang* are fitted up for carriage of petroleum in bulk, and her bunkers are also arranged for carrying liquid fuel, with which object the main boiler and donkey boiler will also be fitted with a special apparatus for burning petroleum refuse or astatki, which is practically the only fuel now used on the Caspian Sea. The vessel will be fitted with twin-screw engines on the triple expansion system, manufactured by the Wallsend Slipway and Engineering Company.

LAUNCHES.—Scotch.

Virginia.—On March 24th Messrs. Russell & Co., shipbuilders, Port Glasgow, launched from the Kingston yard a large steel screw steamer of the following dimensions:—Length over all, 298 ft.; breadth, 38 ft.; depth of hold, 20 ft. 5 in. She is 1,600 tons net, with a deadweight carrying capacity of 3,600 tons. The new vessel, which is named the *Virginia*, has been specially built for the grain trade, to the order of Mr. Frederick Woods, London. Her construction has been superintended by Mr. David Pollock, consulting naval architect, Glasgow. She will be supplied by Messrs. James Howden & Co. with her machinery, the engines being of the triple-expansion type, and the boilers being fired under forced blast on Mr. Howden's system.

Small screw steamers.—On March 24th Messrs. William Simons & Co., Renfrew, launched two small screw steamers for passenger service in the Mediterranean. Steel is used exclusively in the construction of their hulls, they are flush-decked, and have fore and aft saloon accommodation for passengers. The engines are compound surface condensing, of 85 H.P., and the boilers are constructed of steel for a working pressure of 120 lbs. per square inch.

Domira.—On March 28th Messrs. Alexander Stephen & Sons launched from their shipbuilding and engineering works at Linthouse, a finely modelled steel screw steamer, 260 ft. by 36¼ ft. by 18 ft., and about 1,800 tons gross, built to the order of Messrs. Maclay & M'Intyre, Glasgow, and intended for the Mediterranean and general trades. The vessel has been constructed under special survey at Lloyd's for their highest class of 100 A1, and is of the improved well-deck type—the bridge being extended so as to take in the two masts—and as the whole of the bridge space (except in way of engine and boiler casing) is reserved for cargo, the vessel, besides being a large deadweight carrier, has an unusually large measurement capacity. The whole of the accommodation for captain, officers, and engineers is in houses on top of main bridge, this being a speciality of the design. The crew are located in the usual topgallant forecastle, and the latter being joined to the bridge deck by a gangway, communication can be had fore and aft in the heaviest weather without requiring to go down on deck. The vessel has double bottom on the cellular principle for water ballast, and is fitted with steam windlass, steam-steering gear, steam winches, and all the most approved appliances for the expeditious working of ship and cargo. The engines, which were fitted on board before launching, are of the most improved triple expansion type, having cylinders 18 in., 29 in., and 46 in. diameter by 39 in. stroke, with steel boiler of ample size suitable for 160 lbs. working pressure. The vessel, which is of similar dimensions to the *Victoria* recently built by Messrs. Stephen for the same owners, was named the *Domira* by Mrs. W. Macadam Smith, Newhall, Dowanhill Gardens.

Moss Rose.—On March 28th there was launched from the shipbuilding yard of Messrs. Mansel & Aitken, at Ardrossan, a new wooden three-mast schooner the *Moss Rose*, built for the firm of Messrs. Copack, Carter & Co., Connah's Quay. The naming ceremony was performed by Miss Rennie, daughter of the general manager of the company. The dimensions of the *Moss Rose* are:—Length, 109 ft.; breadth of beam, 23 ft.; depth of hold, 11·2 ft.; and her registered tonnage is 150.

Biobio.—On March 29th Messrs. R. Napier & Sons launched from their shipyard at Govan a steel twin-screw steamer for the Compania Sud Americana de Vapores, of Valparaiso. This vessel has been built to the instructions of Mr. Thomas Dewsbury, Leeds, and has been specially designed to meet the requirements of the company's Pacific coasting trade, being intended to carry a large cargo on a light draught of water, while comfortable accommodation has been provided amidships for the passengers. The principal dimensions are:—Length, 170 ft.; breadth, 32 ft; depth to awning deck, 17 ft. 6 in.; and classed at Lloyd's under special survey. The machinery, which has been constructed at the builders' Lancefield Works, consists of two sets of triple-expansion engines for 150 lbs. pressure, and fitted with all the most recent improvements to attain efficiency and economy. As the vessel moved off the ways she was named the *Biobio* by Miss Mary Dewsbury, of Leeds.

Red Eagle.—On March 31st Messrs. Ramage & Ferguson, Leith, launched from their yard a steel screw steam yacht, of about 300 tons, built to the order of Sir George S. Stucley, Bart., of Bideford, Devonshire, and of the Royal Yacht Squadron. The principal dimensions are:—Length, 142 ft. 6 in.; breadth, 21 ft.; depth, 12 ft. 3 in. moulded; and the engines are triple-expansion, with cylinders 13 in., 21 in., and 34 in. in diameter, by 22 in. stroke, supplied with steam at a pressure of 150 lbs. per square in. from a steel boiler having two patent corrugated furnaces. The yacht, which is designed by Mr. St. Clare Byrne, of Liverpool, is fore-and-aft rigged, with sails by Lapthorn, and the houses on deck comprise deck saloon, pantry, chart-room, &c. The principal sleeping cabins are forward. A manganese bronze propeller has been fitted, and a very high rate of speed is expected. The yacht was named the *Red Eagle* on leaving the ways by Mrs. St. Clare Byrne, of Liverpool.

Lady Torfrida.—On April 2nd there was launched from the yard of the Fairfield Shipbuilding and Engineering Company (Limited), Govan, a steel screw steam yacht, built for Sir William Pearce, Bart., M.P. She has been built to Lloyd's highest class of steel, supplied by Messrs. David Colville & Sons, Dalzell Steel and Iron Works, Motherwell; has a clipper stem with figurehead, and elliptical stern. She is 216 ft. 6 in. long, 27ft. beam, and 19 ft. depth moulded, and her tonnage is 735. The vessel is schooner-rigged, with long, rakish masts, is fitted with a steam windlass forward, and hand and steam steering gear aft, with a small steering wheel on the bridge amidships. All the deck fittings, usually made of iron, are of manganese bronze. There is a large steel deckhouse amidships covered with teak, enclosing the engine and boiler space, deck saloon, and smoking room, and in addition affording entrances to the cabins forward and aft. From the main saloon is a corridor, on either side of which are disposed the guests' state-rooms, of which there are six forward and two aft. The accommodation for the officers and crew is provided aft. The yacht will be fitted with triple-expansion engines. These engines will have two high-pressure cylinders, one medium-pressure cylinder, and two low-pressure cylinders, making five cylinders in all. The two high-pressure cylinders are placed above, and the medium-pressure cylinder between the two low-pressure cylinders; thus arranged they work a three-throw crank shaft. The valves are all arranged to work by double eccentric and link motion. A piston valve is fitted to each high-pressure cylinder, and an ordinary slide-valve to each of the other cylinders. The reversing of the engine is effected by one of Messrs. Brown Bros.' steam and hydraulic reversing engines. The crank shaft is in one forging, and together with the thrust, tunnel, and propeller shafts, are made of Messrs. Vickers, Sons & Co.'s steel. The propeller has four blades, and is cast solid of manganese bronze. Steam will be supplied to the engine by one single-ended boiler, having four corrugated furnaces. The boiler is constructed entirely of steel for a working pressure of 150 lbs. per square inch. There will also be an auxiliary boiler fitted on board for supplying steam to the electric light engines, and for other auxiliary purposes. The *Lady Torfrida* is fitted throughout with every modern appliance for working convenience.

Adderley.—On April 12th there was launched from the shipbuilding yard of Messrs. John Reid & Co., Port Glasgow, a steel sailing barque of 1,237 tons gross register. Her dimensions are:—Length, 218 ft.; breadth, 36 ft. 3 in.; depth, 22 ft. This vessel has been built for Messrs. C. W. Kellock & Co., of Liverpool, and will be commanded by Captain Haines, late of the well-known clipper ship *Cedric the Saxon*, also built by Messrs. Reid and Co. The vessel has been named the *Adderley*, which is the name of the seat in Shropshire of H. Reginald Corbet, Esq., Master of the South Cheshire Foxhounds. The ceremony of christening was gracefully performed by Mrs. J. M. Forrester, Glasgow. On completion the *Adderley* will proceed in ballast for Liverpool, where a full cargo has been engaged for her.

Camp Hill.—On April 12th there was launched from Messrs. Russell & Co.'s yard, at Port Glasgow, a steel screw steamer of 2,300 tons deadweight, built to the order of Messrs. M'Beth and Gray, Glasgow, for general trades. This boat is of the latest type of cargo steamers, having all modern improvements for the safety of the crew and the quick handling of cargo. Triple

expansion engines are being supplied by Messrs. Kincaid & Co., Greenock. On leaving the ways the vessel was named *Camp Hill* by Mrs. Gray, Pollokshields.

Fusilier.—On April 14th Messrs. J. M'Arthur & Co. launched from their shipbuilding yard, at Paisley, a paddle steamer named the *Fusilier*, built by them for Mr. David M'Brayne, and will form an addition to his large fleet of West Highland steamers. The dimensions of the new steamer are:—Length, 200 ft.; breadth, 21 ft. 6 in.; and depth, 8 ft. 3 in. All the usual conveniences requisite for passenger traffic will be supplied, and the steamer throughout will be fitted up in a comfortable and tasteful manner. The engines are being supplied by Messrs. Hutson and Corbett, Glasgow, and will indicate about 900 H.P.

Macassa.—On April 14th Messrs. William Hamilton & Co. launched from their yard, at Port Glasgow, a steel screw steamer named the *Macassa*, of the following dimensions:—Length, 155 ft.; breadth, 24 ft.; depth, 16 ft. 3 in.; and of 459 tons gross register. She has been built to the order of the Hamilton Steamboat Company (Limited), Hamilton, Ontario, and will be employed in the passenger trade between Toronto and Hamilton. The *Macassa* is fitted up with a spacious saloon on deck, in addition to a saloon aft about 36 ft. long. Mr. William Kemp, engineer, Govan, provides and fits up two sets of triple-expansion engines of 11 in. and 18 in., and 29 in. by 22 in. stroke, and of 700 I.H.P.

Volunteer.—On April 14th, at Dumbarton, Messrs. A. M'Millan & Sons, of the dockyard, launched the second of two composite screw steamers, built by them for the Government mail and passenger traffic round the coasts of Newfoundland. The vessel, which was named the *Volunteer*, is of the following dimensions:—Length 190 ft., breadth 30 ft., depth 22½ ft.; gross tonnage, 750. She has been built to contend with the ice which is to be so frequently met with in the course of her passage. The construction of the vessel forward is of very great strength, and the stem and bows are shod with heavy iron plates to protect the wood planking when cutting into heavy ice. The planking, which is mostly of heavy greenheart, is fastened with stout metal bolts, the casing being down to the load water-line, the sides being of iron. The vessel is having machinery of the triple expansion type made by Messrs. David Rowan & Son, of Glasgow, and is of 800 I.H.P. She is fitted for 68 first-class and 90 intermediate passengers, the whole accommodation being in the 'tween decks. The vessel will be worked by Messrs. Harvey & Co., of St. John's, Newfoundland, who have the contracts with the Government.

Ruby.—On April 16th there was launched from the shipbuilding yard of Messrs. Scott & Co., Bowling, an iron screw steamer of the following dimensions:—175 ft. by 26 ft. 6 in. by 13 ft. moulded, built to the order of Mr. Wm. Robertson, Glasgow, and will be an addition to his coasting fleet. The vessel is built on the cellular double-bottom principle, considerably in excess of Lloyd's requirements for their highest class, and fitted with all the latest improvements for working, including Alley & Maclellan's "sentinel" steam steering gear, &c. Triple expansion engines, 15 in. 25 in. and 40 in. by 30 in. stroke, will be fitted on board by Messrs. W. King & Co., Dock Engine Works, Paisley-road, Glasgow. On moving down the ways the steamer was named *Ruby* by Miss Agnes Cassels Millar, Langside. After the launch the vessel was towed to Glasgow to receive the machinery.

Marion Lightbody.—On April 17th there was launched from the yard of Messrs. David & William Henderson & Co., Meadowside, Partick, a steel four-masted sailing ship of the following dimensions, viz:—Length, 287 ft.; breadth, 42 feet 6 in.; depth, 24 ft. 1 in.; with a gross tonnage of 2,155 tons. The vessel is owned by Messrs. Rogers & Co., of Glasgow and Valparaiso, and is fitted with all the latest improvements for the safe working of the ship and speedy discharge of cargo, including Messrs. Emerson & Walker's patent windlass, Shaw and Hastie's patent halliard winches for hoisting topsails and topgallant yards, and Rodger's steam winch and donkey boiler. On leaving the ways the vessel was named *Marion Lightbody* by Miss Edmonds, daughter of William Edmonds, Esq., of Wiscombe Park, Honiton. The vessel will be commanded by Captain William Cordiner, late of the ship *Marion Inglis*, belonging to same owners.

LAUNCHES—Ireland.

Idar.—On April 14th there was launched from the shipbuilding works of Messrs. Harland & Wolff, Queen's Island, Belfast, a screw steamship, built to the order of Messrs. Edward Bates & Son, of Liverpool. Her dimensions are:—Length, 400 ft.; breadth of beam, 45 ft; gross tonnage, 4,050. The vessel will be worked by triple-expansion engines of 2,200 I.H.P. She will be supplied in all departments with the latest improvements, steam steering gear, steam windlasses of the newest construction, &c. She will be rigged and fitted out at Belfast. This steamship is named the *Idar*, and is intended for the same trade as the *Iran*, which was built for Messrs. Bates & Son a short time since. She is classed 100 A 1 at Lloyd's.

Lorton.—On April 14th there was launched by Messrs. Workman, Clark & Co. (Limited), from their shipyard at Spencer Basin, Belfast, a steel sailing barque, built for Messrs. P. Iredale & Son, Liverpool. As the barque left the ways she was christened the *Lorton* by Mrs. John Porter, Carrickfergus. The dimensions of the vessel are:—Length, 241 ft. 8 in.; breadth, 27 ft. 4 in.; registered tonnage, 1,360; class at Lloyd's, 100 A 1. She has a half poop deck and topgallant forecastle. The crew are berthed in an iron house on the main deck forward, and the apprentices under the half-poop, while the saloon, captain's and officers' rooms, bath, &c., are also fitted at the stern under the poop deck. The masts, bowsprit, and principal yards are made of steel. The standing rigging is of steel wire, and the running gear of flexible steel wherever practicable. Harfield's patent windlass is used, and is driven by a capstan placed on the forecastle head. It is also geared to suit being worked from the steam winch. The donkey boiler and steam winch are in an iron house at the main hatch. There are also powerful hand-winches at the other hatches. After the launch the vessel was towed to the large shearlegs at Abercorn Basin, where her masts will be shipped. When ready for sea she will proceed to Maryport or Liverpool to load a general cargo for Portland (Oregon), having been specially built for this trade. The *Lorton* will be under the command of Captain Remington, commodore captain of Messrs. Iredale's fleet.

TRIAL TRIPS.

James Drake.—On March 21st the steamer *James Drake*, belonging to Messrs. Wilkie and Turnbull, of North Shields, left the Wear to take her official trial trip, after having had her engines converted from the ordinary compound to quadruple expansion on the two-crank system, and a new boiler, fitted to work at a pressure of 170 lbs. per square inch. The alterations to the machinery have been carried out by Mr. John Dickinson, of Palmer's Hill Engine Works, and the ship work by Messrs. Bartram and Haswell, South Docks. After taking the owners and friends on board off the *Tyne*, the vessel was run north for about four hours, and then back to the *Tyne*, making in all a continuous run of about seven and a half hours, during which time no hitch of any kind occurred, and a mean speed of 10½ knots was obtained, which was considered highly satisfactory by all concerned.

Chia Shih.—On March 22nd the new steamship *Chia Shih*, built by Messrs. R. and W. Hawthorn, Leslie & Company, had her preliminary speed trials at sea. The *Chia Shih* was built for the Formosa Trading Corporation, to the order of Messrs. Russel and Company, London and China. Her dimensions are 250 ft. by 34 ft. beam by 19 ft. moulded; and she is classed 100 A1 at Lloyd's. She is fitted with a twin screw and triple expansion engines. A mean speed of 15·276 knots per hour was attained, the rates being considerably higher than that contracted for. Her furnaces are supplied with means of obtaining forced draught. The vessel has passenger accommodation in the form of saloons for first-class Europeans and natives, and also for second-class native travellers. She was built under the inspection of Messrs. A. and W. Dudgeon, as representatives of Messrs. Russel & Co., and of Mr. J. Cromarty, representing the governors of the Formosa Trading Corporation. The trial was considered highly satisfactory.

Alagoas.—On March 24th the screw steamer *Alagoas* built by R. and W. Hawthorne, Leslie & Co., for the Brazilian mail service, had a successful trial trip, the speed attained being 15¼ knots. The vessel is built of steel, and the dimensions are:—276 ft. by 38 ft. by 21 ft. 6 in. Accommodation is provided for 500 passengers, and the fittings are of an elaborate and complete character. The vessel has been built to take the highest class at Lloyd's.

Impérieuse.—On March 24th the *Impérieuse*, Captain May, made a three hours' commissioned trial of her engines in the Solent, under the superintendence of the officers of the Steam

Reserve. Her immersion, in consequence of her coal-stores having been increased from 400 tons to 900 tons, was greater than when she had a couple of iron military masts. Her forward draught was 25 ft. 10 in. and after draught 28 ft. 9 in., which gave her a mean immersion of 27 ft. 3½ in. But as it is intended to put 200 tons of coal additional on board, and as 37 tons of weight are estimated to sink her an inch, her mean draught will eventually be close upon 28 ft., which will bring the top of her side armour awash. The steam trial was remarkably successful. She was driven at her full natural draught power, the fans being kept turning for purposes of ventilation only. The mean steam pressure in the boilers was 85·79 lbs., the vacum 27 and 26 in. in the starboard and port condensers respectively, the revolutions 78 and 78½, the H.P., 3,478·6 (starboard) and 3,500·6 (port) giving a collective I.H.P. of 6,979·27. The average speed realised as tested by the measured mile was 16 knots, the depth of the propellers having evidently increased their efficiency.

Choy-Sang.—On March 26th the steel screw steamer *Choy-Sang*, 1,900 tons, built for the Indo-China Steam Navigation Company, Limited, by Messrs. Hall, Russell & Co., Aberdeen, underwent her trial trip for speed in Aberdeen Bay. The results were very satisfactory, the mean speed being 12·1 knots per hour and the engines working with great smoothness.

Iris.—On April 6th the *Iris*, despatch vessel, at the conclusion of an extensive refit, made a two hours' full-power trial of her machinery in the Solent. The engines developed a mean power of 7,140 horses, and an average speed of just over 18 knots was realized. A satisfactory trial was also made of the steam-steering gear.

Merida.—On March 28th the *Merida*, built by Messrs. E. Withy & Co., of West Hartlepool, to the order of Messrs. H. Bucknall & Sons, of London, and engined by Messrs. Blair and Co. (Limited), of Stockton, had her trial trip. The vessel is 290 ft. long and 38 ft. broad, and her engines are on the triple expansion principle, of 170 H.P.N., with cylinders 21½ in., 35½ in., and 58½ in. in diameter, by 39 in. stroke, and working at 160 lbs. pressure of steam. The vessel made a most successful run without any hitch whatever, carrying over 3,000 tons of cargo, and drawing 21½ ft. of water. She attained a speed of over 9 knots an hour.

Fulford.—On April 7th the steamship *Fulford*, which has been built by Messrs. Raylton, Dixon & Co., Clevcland Dockyard, Middlesbrough, to the order of J. M. Lennard & Sons, of Middlesbrough, took her trial trip. Her leading particulars are:—Length over all, 267 ft.; breadth, 36 ft.; depth, 19 ft. 6 in. moulded; having a deadweight capacity of 2,500 tons; double bottom for water ballast throughout, direct steam windlass, four steam winches, and all the latest improvements for rapid loading and discharging of cargo. She is built on the well-deck type, but with long bridge extending to foremast. Her engines, which are by Messrs. Blair & Co., Limited, of Stockton, are on the triple expansion principle, having cylinders 20 in., 33 in., and 54 in. by 36 in., and during the trip worked most satisfactorily, a speed of 9½ knots being attained. On completion of trial she proceeded on her voyage.

Charters Tower.—On April 11th the steel screw steamer *Charters Tower*, built by Messrs. John Readhead & Co., West Dock, South Shields, was taken to sea on her trial trip. Her dimensions are:—317 ft. by 40 ft. by 25 ft. 6 in., having a gross register of 2,927 tons, and a deadweight capacity of 4,600 tons. She has a poop, large bridge-house amidships, and topgallant forecastle, and is built on the cellular bottom principle, with water ballast capacity of 600 tons. The vessel and machinery have been built under the special survey of Lloyd's surveyors to class 100 A1. The engines are of the triple expansion type, having cylinders 23 in., 37½ in., and 61½ in. in diameter, with 39 in. stroke, and are supplied with steam at a pressure of 160 lbs. from two large steel boilers. The engines and boilers are fitted with every appliance for securing economy and high efficiency, having patent feedwater heaters, evaporators, &c. The engines and boilers have also been built by Messrs. John Readhead & Co. The vessel and machinery during construction have been inspected by Mr. H. C. Ashlin, London, assisted by Captain M'Nabb, of Newcastle. After adjusting compasses, the steamer made several runs to the north and south of the Tyne, and also on the measured mile, where she attained a speed of 12 knots per hour. The machinery worked very smoothly, the results giving great satisfaction to all concerned. The *Charters Tower* has been built to the order of Messrs. F. Stumore & Co., of London, and is the second steamer of that name built by Messrs. Readhead for this firm. She will be under the command of Captain Hamblin.

Caucase.—On April 12th the trial trip took place of the tank steamer *Caucase*, recently built by Messrs. Sir W. G. Armstrong, Mitchell & Co., at their Low Walker Shipyard, her tanks being filled with water to represent the full weight of the oil cargo, viz., 2,400 tons. She is built to the highest class Veritas, and her general construction is similar to that of the other oil boats, of which the above firm have built a large number. The *Caucase* is divided into a number of compartments, the workmanship of which is like boiler work. The vessel has a complete installation of pumps and piping for discharging the cargo, and is fitted throughout with the electric light. The machinery, which is on the triple-expansion system, has been manufactured by the Walls-end Slipway and Engineering Company, and during the trial gave the greatest satisfaction.

Algonquin.—On April 12th the screw steamer *Algonquin*, recently launched by Messrs. Napier, Shanks & Bell, Yoker, was taken out for trial over the Admiralty measured mile at Skelmorlie. The vessel is 245 ft. by 40 ft. by 23 ft., specially designed with full lines for carrying a large deadweight of grain on limited draught through the Canadian lakes, and after being navigated to Montreal, is to be cut in two for passage through the canals, and put together again on Lake Ontario. The engines, of most improved and economical type, have been constructed by Messrs. Dunsmuir & Jackson, Govan, and worked with great regularity. The vessel, loaded, attained on trial a mean speed of 9·9 knots, a result considered exceedingly satisfactory. The *Algonquin* is expected to be ready for service on the lakes by the end of May.

Circe.—On April 13th this steamer went down the river to the Firth of Clyde for trial previous to being taken over by the owners. She is 332 ft. by 36 ft. by 27 ft., and 2,350 tons gross register, belonging to Messrs. Donaldson Brothers, acquired by them for their North American trade, and recently underwent an extensive overhaul and refit, the contract for which was placed in the hands of Messrs. Barclay, Curle & Co., Limited, engineers and shipbuilders, Glasgow and Whiteinch. In this vessel the original compound engines and four boilers have been replaced by engines of the triple-expansion type, with three cylinders on three cranks. It being the aim of the owners to economise longitudinal space in the ship, while maintaining speed and power to properly meet the requirements of first-class trading vessels, it was necessary to solve the problem of placing the new three-cylinder engines on the three cranks within the same space as originally occupied by the old compound engines, which latter consisted of one high-pressure cylinder of 37 in. diameter, and one low-pressure cylinder of 74 in. diameter by 48 in. stroke, supplied with steam from four single-ended boilers, and indicating 1,200 H.P. These engines have been replaced by others having cylinders 25 in., 41 in., and 68 in. diameter respectively, with a stroke of 48 in., supplied with steam of 160 lbs. pressure from two double-ended boilers. The net result of this alteration is an increase of longitudinal space in the ship of 6 ft. available for cargo, and as the new engines on trial indicated 2,103 H.P., with an economical coal consumpt, the gain in propelling power equals 900 I.H.P. The chief novelty in the engines is the adoption of Morton's patent valve gear, by the use of which eccentrics and link motion is dispensed with, the space usually taken up by the eccentrics on the crank shaft being made available for main bearings, of which there are four, having a total length of bearing surface of 8 ft. The valves being brought round to the side of the engines, and in a direct line with the centre of their respective cylinders, tends materially to shorten the space taken up by the propelling apparatus, and affords easy access to the valve and valve faces when it is desirable. The crank shaft is of the "built" description, and arranged for duplication. The engines and boilers were subjected to a lengthened test, the boiler pressure of 160 lbs. per square inch, and a piston speed of 632 ft. per minute being maintained, the engines working without noise or jar. The ship was tried between the Cloch and the Cumbrae Lights, and, notwithstanding the unfavourable conditions of wind and tide, a speed of 13¼ knots per hour was attained without overworking either the engines or boilers.

Ben Clune.—On April 14th the trial trip of the new steamer *Ben Clune*, of North Shields, took place off the Tyne, under very favourable conditions, the weather being extremely fine and the sea smooth. The *Ben Clune* has been built by Mr. James Laing, of Sunderland, for Messrs. John Morrison & Son, of North Shields, and is built of steel, upon the web frame principle. The bridge is extended to the foremast, and provides accommodation for the crew in the fore part, and for the officers and engineers in the after part. Her dimensions are:—Length, 273·5 ft.; beam,

38·25 ft.; depth of hold, 19·35 ft. She had on board about 2,550 tons of cargo and bunkers, upon a draught of water 19·6 ft., the deadweight being in excess of the estimated capacity. The engines, built by Mr. George Clark, of Sunderland, are upon the tri-compound principle, with cylinders of 21 in., 33 in., and 54 in. diameter, working over three cranks, and the steel boilers are constructed to work at a pressure of 150 lbs. to the square inch. Every modern improvement for the economical working of the machinery has been introduced, and during the series of trials, extending over several hours, the engine worked with the utmost smoothness, and gave great satisfaction to all on board. Various runs were made over the measured mile at different developments of the power of the engines, and the final test at full power gave a speed of 10 knots per hour against wind and tide, and 11½ knots per hour with wind and tide, or a mean speed of 10¾ knots per hour.

Hailoong.—On April 19th the new screw steamship *Hailoong* (She Dragon) recently launched by Messrs. Ramage & Ferguson, Leith, for the Douglas Steam Navigation Company, for service between Hong Kong and Formosa, went on her trial trip on the Firth of Forth. The vessel, which has been constructed for the requirements of the Chinese trade, is built of steel, and is entered in the highest class at Lloyd's, besides posse-sing the Board of Trade foreign sea-going certificate. Her decks and other woodwork are of teak, which is considered most suitable for the climate in which she is to trade. The engines, which have been supplied by the builders, are on the triple-expansion type, and indicated at the trial over 1,300 H.P. The officers of the ship are British, but the crew, who have been specially engaged, are mostly Chinese, Japanese, and Malays. On the measured mile in Aberlady Bay a speed of 12¾ knots an hour was attained.

Correspondence.

[It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—Ed. M. E.]

MEAN PRESSURE OF A COMPOUND ENGINE.

To the Editor of The Marine Engineer.

Sir,—Since I sent you my last statement on the subject of finding the mean pressure, as found per indicator diagrams in the cylinders of a compound engine, I have (from being in possession of some of the main particulars of two well-known crack vessels, built and engined on the Clyde, and a third built and engined by a well-known firm on the lower reaches of the Clyde), for the purpose of showing the correctness of the method, and how it may be applied in different cases, worked carefully out the following statements. I must mention that in the first two cases I do not know what was the actual setting of the slide valves, but from knowing the H.P. developed, I can come very near it. I have, at any rate, arranged the cut-off in both H. and L. pressure cylinders to give out, I may say, the greatest power considerate with good working. So, to proceed. The boiler pressure is 90 lbs., or 105 lbs. absolute, the cut-off in H.P. cylinder is to be 1·4, and cut off in L.P. cylinder 1·69, or ·59 of stroke. The stroke is 6 ft., and revolutions per minute 64; and taking the clearance in the cylinders at $\frac{1}{10}$ their net capacity, the ratio of cylinders 3·58, and allowing 3 lbs. for loss of pressure between boilers and admission of steam to H.P. cylinder. Then to find receiver pressure—

$$1{\cdot}4\,\frac{1+{\cdot}1}{1+1{\cdot}4\times{\cdot}1}=1{\cdot}35$$

$$\frac{105\text{ lbs.}}{1{\cdot}35}\times\frac{1}{3{\cdot}58\times{\cdot}59}\text{ or }77{\cdot}77\times{\cdot}47=36{\cdot}55\times{\cdot}83=30{\cdot}33\text{ lbs.}$$

receiver pressure.

$$\frac{1+\text{hyp. log. }1{\cdot}4}{1{\cdot}4}={\cdot}954$$

·954 × 105 lbs. = 100·17 lbs. — (3 + 36·33) = 66·34 × ·84 = 56·14 lbs. mean effective pressure in H.P. cylinder. Now to find mean pressure in L.P. cylinder.

1 + hyp. log. 1·69 = 1·5247 × 30·33 lbs. = 46·24 + 2·75 constant = 16·8 lbs. mean effective pressure in L.P. cylinder. Now, the mean pressure referred to one cylinder, will be 16·8 lbs. + $\frac{56{\cdot}14}{3{\cdot}58}$ = 32·48 lbs. Now, supposing this vessel is to steam 16·7 knots per hour at sea, what H.P. will be required to give out this speed, her length between perpendiculars being 470 ft., breadth of beam, 57 ft. 2 in., and depth moulded 37 ft. 2 in. on a load draft of, say, 29 ft.? The allowance for slip is 15 per cent.

Then

$$\frac{16{\cdot}7^3\times 470\times(57{\cdot}16+58\text{ two drafts})\times{\cdot}78}{20000}=9831{\cdot}35\text{ H.P.}$$

Now to find area of cylinders to give out this power effectively, we have

$$\frac{9831{\cdot}35\times 33000}{32{\cdot}48\text{ lbs.}\times 768\text{ ft. per min.}}=13006{\cdot}18\text{ area of L.P. cylinder.}$$

13006·18 ÷ 3·58 ratio = 3633·00 ,, H.P. ,,

or area of two L.P. cylinders 6503·09 each, or two L.P. cylinders 91 in. in diameter, and one H.P. cylinder, 68 in. diameter. Now that we have fixed on the area of cylinders, we can calculate the H.P. from the mean pressure and the travel in feet per minute, or revolutions 64 × 12 ft. = 768 ft. The area of two L.P. cylinders, 91 in. in diameter is 13007·7948, and the area of one H.P. cylinder, 68 in. in diameter, is 3631·6896. So

$$\frac{13007{\cdot}7948\times 16{\cdot}8\text{ lbs.}\times 64\times 12\text{ ft.}}{33000}=5085{\cdot}81\text{ H.P., L.P. cylinder.}$$

$$\frac{3631{\cdot}6896\times 56{\cdot}14\text{ lbs.}\times 64\times 12\text{ ft.}}{33000}=4744{\cdot}91\text{ H.P., H.P. cylinder.}$$

5085·81 + 4744·91 = 9830·72 H.P. combined, which is nearly the same as found above, thus showing that cylinders of the above dimensions are large enough to give out the required power, with a boiler pressure of 90 lbs., and the slide valves arranged to cut off steam as already stated. I may here state that this vessel, which is a vessel of fine lines and a mail steamer, averaged 17 knots per hour on her best voyage between Liverpool and New York. So that there is no getting out of this fact.

2nd case.—The boiler pressure is 100 lbs., or 115 lbs. absolute pressure; the cut off, as arranged, is 1·6 in H.P. cylinder, and 1·72 in L.P. cylinder, or ·58 of stroke, the stroke being 5 ft. 6 in., the ratio of cylinder 4·21, the clearance $\frac{1}{10}$ as before, and revolutions per minute 64.

$$1{\cdot}6\,\frac{1+{\cdot}1}{1+1{\cdot}6\times{\cdot}1}=1{\cdot}51$$

$$\frac{115\text{ lbs.}}{1{\cdot}51}\times\frac{1}{4{\cdot}21\times{\cdot}58}\text{ or }75{\cdot}15\times{\cdot}409=30{\cdot}72\times{\cdot}87=26{\cdot}74\text{ lbs.}$$

receiver pressure.

$$\frac{1+\text{hyp. log. }1{\cdot}6}{1{\cdot}6}={\cdot}918$$

·918 × 115 lbs. = 105·57 lbs. — (3 + 26·74) = 75·83 × ·84 = 63·69 lbs. mean effective pressure in H.P. cylinder.

1 + hyp. log. 1·72 = 1·542 × 26·74 = 41·23 ÷ 2·75 = 15 lbs. mean effective pressure in L.P. cylinder.

Now, supposing this vessel is to steam 16·681 knots per hour at sea; length 430 ft., breadth 50 ft., depth moulded 33 ft., on a draft of, say 27·5 ft.

$$\frac{16{\cdot}681^3\times 430\times(50+55\text{ two drafts})\times{\cdot}78}{20000}=8173{\cdot}133\text{ H.P.}$$

Now, to find area of L.P. cylinder, we have 15 lbs. + $\frac{63{\cdot}69}{4{\cdot}21}$ = 30·12 lbs. Then

$$\frac{8173{\cdot}133\times 33000}{30{\cdot}12\times 704\text{ ft.}}=12719{\cdot}64\text{ area of L.P. cylinder.}$$

12719·64 ÷ 4·21 ratio = 3021·29 ,, H.P. ,,

or two L.P. cylinders 90 in. in diameter, and one H.P. cylinder 62 in. in diameter. Now to find H.P. from diameter of cylinders, as found above—

Area

$$\frac{12723{\cdot}48\times 15\text{ lbs.}\times 64\times 11\text{ ft.}}{33000}=4071{\cdot}51\text{ H.P., L.P. cylinder.}$$

Area

$$\frac{3019{\cdot}0776\times 63{\cdot}69\text{ lbs.}\times 64\times 11\text{ ft.}}{33000}=4102{\cdot}08\text{ ,, H.P. ,,}$$

4071·51 + 4102·08 = 8173·59 H.P. combined.

Now, this vessel deeply laden, or with 1,300 tons less than her register tonnage on board, it being 4,300 tons, steamed on trial 18·18 knots per hour; but it was allowed that fully a knot was due to her propeller, which was made of manganese bronze, its

diameter being 24 ft. 4 in., and pitch 31 ft.; revolutions on trial, 66½. I have allowed 14·79 per cent. slip, so that this vessel could steam 17 knots per hour at load draft steadily.

Case 3rd.—Boiler pressure, 60 lbs. or 75 lbs. absolute; cut off in H.P cylinder 1·34, and L.P. cylinder 1·53, or ·65 of stroke, the stroke being 4 ft., and revolutions per minute 65; and taking clearance in both cylinders at $\frac{1}{10}$ their net capacity as before, the ratio of cylinders being 2·918. Then to find receiver pressure—

$$1{\cdot}34\ \frac{1+{\cdot}1}{1+1{\cdot}34\times{\cdot}1}=1{\cdot}299$$

$$\frac{75\text{ lbs.}}{1{\cdot}299}\times\frac{1}{2{\cdot}918\times{\cdot}65}\text{ or }57{\cdot}7\times{\cdot}527=30{\cdot}407\times{\cdot}83=25{\cdot}23\text{ lbs.}$$

receiver pressure.

$$\frac{1+\text{hyp. log. }1{\cdot}34}{1{\cdot}34}={\cdot}964$$

·964 × 75 lbs. = 72·3 — (3 + 25·23) = 44·07 × ·84 = 37·01 lbs. mean effective pressure in H.P. cylinder.

1 + hyp. log. 1·53 = 1·4252 × 25·23 lbs. = 35·957 + 2·75 = 13·07 lbs. mean effective pressure in L.P. cylinder.

$$13{\cdot}07\text{ lbs.}+\frac{37{\cdot}018}{2{\cdot}918}=25{\cdot}75\text{ lbs. mean, referred to one cylinder.}$$

D. McMILLAN.
s.s. *Merkara.*

RESISTANCE OF SQUARE BARS TO TORSION.

To the Editor of THE MARINE ENGINEER.

SIR,—In a discussion on this subject at a recent meeting of the North-East Coast Institution of Engineers, Rankine's formula,

$$\cdot281\,fh^3,$$

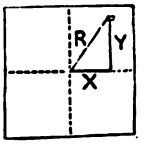
where h = side of the square, and f = greatest stress in lbs. per square inch, was quoted and accepted as correct without any of the engineers present—many whose names are well known as combining theoretical with practical knowledge—having raised a dissenting voice. The same formula is also given in a deservedly popular book, Unwin's "Elements of Machine Design." In the volume of the "Encyclopædia Britannica" just issued, Professor Ewing's article on the steam-engine quotes the same expression.

In writing a synopsis of the derivation of the formula for a pupil, I noticed the fact that the resistance to torsion of a round bar, diameter = d, and *area same as that of a square bar* side = h, is, by the ordinary well-known formula,

$$\frac{3{\cdot}1416}{16}fd^3=\frac{fh^3}{2\sqrt{3{\cdot}1416}}={\cdot}282\,fh^3;$$

almost the same as Rankine's, whose result must therefore be much too large. This led me to turn up the original papers Rankine quotes as his authority (Saint-Venant's), where the source of the error is seen; but a little detail is necessary to exhibit it clearly.

The well-known "modulus" for the resistance to bending of a rectangular bar, $\frac{bh^2}{6}$, where b = breadth and h = depth, becomes, for a square bar, $\frac{h^3}{6}$. The moment of resistance to torsion, on the old theory, is the sum of the moments of resistance to bending in two directions at right angles to one another, namely, *horizontal* and *vertical*, because



$$r^2=x^2+y^2,$$

where r^2 may be taken to represent the torsional moment of resistance of a small element of the area; x^2 to represent its bending moment of resistance in a horizontal direction, and y^2 its bending moment of resistance in a vertical direction. The torsional modulus thus becomes, for a square shaft,

$$\frac{h^3}{6}+\frac{h^3}{6}=\frac{h^3}{3}$$

on the old theory.

Now in Saint-Venant's "Mémoire," the *torsional rigidity* of a square bar is proved to be the fraction

$$\cdot843$$

of the fallacious result of the old theory. Rankine accordingly wrote

$$\cdot843\times\frac{fh^3}{3}=\cdot281\,fh^3$$

as the true moment of torsion.

But the *torsional rigidity* determines the *amount of twist* and not the *maximum stress*. A few pages farther on Saint-Venant gives the correct value of the moment of resistance, which is, when altered to correspond to our notation,

$$\cdot208\,fh^3.$$

This is printed in large type to call attention to it until the prevalent error is expunged from all our authoritative works.

Since writing the foregoing, I find that Rankine's error is mentioned in an appendix to Professor Cotterill's "Applied Mechanics," but the author says Rankine gives the formula without further explanation. The explanation I now give for the first time. Being an old pupil of Rankine's, I may state that he was very busy composing his books when the results of Saint-Venant's investigations were published, and it is clear he had only hurriedly glanced at them. He took the formula for the *strain* instead of that for the *stress*. Up to that date, the strain and stress were supposed to be proportional to each other.

An abstract of Saint-Venant's researches is to be found in such readily accessible sources as the *Ency. Brit.* article "Elasticity," by Sir William Thomson, "Thomson and Tait's Natural Philosophy," and "Minchin's Statics." In all of these prominence is given to the methods which determine the *strain* to be ·843 of the old fallacy, while none of them even mention the result of chief importance to engineers, namely, that which determines the *stress*, as given above.

The resistance to torsion of square bars is important in calculations regarding safety valve springs, and in numerous other applications, many of which are mentioned in the Transactions of the Institution of Engineers referred to above.

Yours truly,

T. I. DEWAR.

Engineering Academy, 721, Commercial Road, E.

A BREAKDOWN.

To the Editor of THE MARINE ENGINEER.

SIR,—The following account of a breakdown may interest some of your readers.

In November last, when on a voyage from North-East Coast to Italy, being in Gulf of Lyons, the H.P. piston, 33 inches in diameter, broke into a number of pieces. After finding all the pieces, and jointing cylinder cover, removed H.P. valve gear, and dropped valve till top steam port was full open. I had to keep fore connecting rod on, as air and feed pumps were on fore engine. Fore engine is leading engine. After several attempts to start ahead, and finding that L.P. engine would not pass centres, the ahead going sheave was put back half inch on shaft, and engines were started astern. The engines going astern passed centres easily, owing to the H.P. helping L.P. over bottom centre. Engines were run astern for half an hour, but ship would not steer, and, after getting vacuum as high as possible, the engines started ahead at first attempt, with steam at 60 lbs.

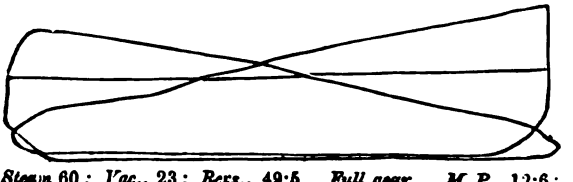
The cause of break was a core-hole plug coming out of bottom of piston. The engines are $\frac{33\text{ in.}\times 62\text{ in.}}{39\text{ in.}}$

The $\frac{1}{6}$ in. diagram was taken the day before the accident. The $\frac{1}{16}$ in. are single engine cards. You will notice that when linked up the speed increased without the throttle valve being opened any further. The average speed was 7 knots. The consumption was slightly increased.

D. R.

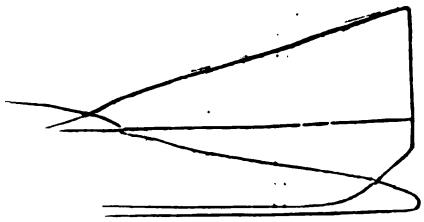
Sunderland, March 8th, 1888.

SINGLE ENGINE CARD.



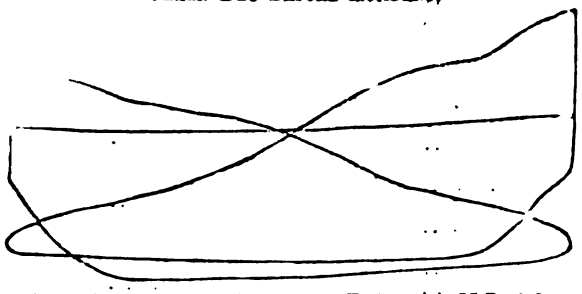
Steam 60; *Vac.*, 23; *Revs.*, 49·5. *Full gear. M.P.*, 12·6; *I.H.P.*, 322. *Throttle Valve at First Grade.*

SINGLE ENGINE CARD.



.., 52. *Gear*, 1½ *turn back*. *M.P.*, 12·9; .. *Throttle Valve at First Grade.*

.AKEN DAY BEFORE ACCIDENT,



Steam, 70; *Vac.*, 23; *Revs.*, 63. *Full gear*. *M.P.*, 9·2; *I.H.P.*, 345.

Reviews.

Lockwood's Dictionary of Mechanical Engineering Terms. By A Foreman Pattern-maker. London: Crosby Lockwood & Co.

THE author of the present work is also the author of "Pattern Making," a book which, though only recently published, has made considerable headway, and has won well-deserved praise. We venture to predict that the present "Dictionary" will make even greater headway, and add still more to the author's laurels. The work comprises some six thousand definitions of mechanical terms, and embracing, as it does, those used in the drawing office, pattern shop, foundry, fitting, turning, smiths' and boil.r shops, &c., leaves no ground uncovered. The definitions are not given in the learned and too often, alas! pedantic style of the lecture room, but in a plain, straightforward, and yet withal lucid and concise manner that leaves nothing to be desired. In fact, every one bears on the face of it evidence of having been written by a man who thoroughly understands and has long practised what he has written about. While the author has done his utmost to render the book useful to those engaged in any or all of the departments of engineering, he has also judiciously restricted himself to what may be termed the legitimate phrases of the profession by discarding all fanciful and unusual terms coined by individual workmen or which are only current in a single shop or district. Further, the value of the book is enhanced to the engineer by the author having determinedly eliminated all matter not directly connected with the practice of engineering. For instance, in wood working and wood working machinery only those terms which concern the engineer are introduced, those which pertain to ornamental joinery and carpentry being omitted. To the engineer student and the amateur worker the present work will prove a boon, enabling them, as it does, to rapidly obtain reliable information on the many technical terms which are constantly cropping up during the course of their reading; while to engineers generally it will always prove a valuable book of ready reference, the contents, as the title implies, being arranged alphabetically. The book is of a handy size, serviceably bound, and printed in a good bold type.

The Architects', Surveyors,' and Engineers' Compendium for 1888. Edited by John E. Sears, A.R.I.B.A. London: E. Marlborough & Co.

THE "Compendium" forms a professional and office diary for 1888 and a directory of manufactures connected with the branches of trade with which it especially deals, such as ironmongery, sanitary, brick, tile, and other goods, many illustrated and priced catalogues being given. A full list of the district surveyors under the Metropolitan Building Act, and also a set of maps showing boundaries of surveyors' districts are given. The maps are rendered additionally useful by having the leading manufacturers' premises marked in red thereon. Many pages are devoted to legal information and legal decisions, interesting alike to the layman and the professional reader. The diary is well arranged, and is supplemented by a cash book and ledger. One coloured and two "photophane" plates are given, each being excellently designed and printed.

The Journal of the Iron and Steel Institute. II.—1887. London: E. and F. W. Spon.

As will probably be remembered by our readers, the members of the Iron and Steel Institute, under the presidency of Daniel Adamson, Esq., last year held their autumn meeting at Manchester. The present volume of the Journal fully recapitulates the incidents of the meeting, and, in addition, gives a very interesting paper, "On the metallurgical and mechanical exhibits at the Manchester Royal Jubilee Exhibition," prepared by Mr. Thomas Ashbury for the occasion. The reception of the Institute, the presentation of the Bessemer medal for 1887, the President's address, and three papers —the first on the "Reduction of Ores of Iron in the Blast Furnace" by Sir Lowthian Bell; the second, "Notes on the Basic Open-Hearth Process," by Mr. J. W. Wailes; and the last, "On Electric Lighting in Works and Factories," by Professor J. A. Fleming—make up what may be termed the business part of the present volume. The rest of the volume, some 230 pages, is devoted to "Notes on the Progress of the Home and Foreign Iron and Steel Industries," and gives some most valuable information on the subject. We regret to notice several well-known names in the pages devoted to Obituary.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from March 16th to April 19th, 1888.

4083 T. L. Neish & J. P. Wilson. Propulsion of ships.
4138 D. Allan. "Templet" for marking the holes in ships' beam ends.
4144 T. Harrison. Mariners' compasses.
4152 J. Gaskell. Steam engine slide valves.
4159 E. C. Greenway. Lifeboats.
4166 Radfern (J. Holmes). Closing holes in ships caused by collision.
4179 R. Garrett. Steam cylinder lubricators.
4234 A. M. Wood. Buoyant cables and netting.
4266 J. W. Gaukroger & W. A. Sykes. Light feed lubricators.
4268 C. J. Fox. Coffer dams for inspecting and repairing submerged portions of ships, &c.
4272 E. E. Wigzell. Taking soundings.
4297 A. G. von Buonaccorsi di Pistoja. Torpedoes.
4339 A. E. Carey. Breakwaters, piers, &c.
4364 Haddan (J. M. y Millet). Safety raft.
4464 Fear (R. S. Munn). Ships' anchors.
4468 G. H. & W. O. Felt. Lubricators.
4480 A. W. F. G. Linnenbrügge. Propelling and steering ships.
4488 A. E. Rugeroni. Dredging apparatus.
4499 G. Cadenhead. Screw propellers.
4514 S. Whitaker. Ships' paddles.
4543 W. J. Gell. Raising and lowering boats.
4544 F. W. P. Bouverie & W. Balch. Life buoy.
4601 H. Vering. Dredgers.
4615 B. Sjövall. Valve gear for two crank engines.
4630 H. E. Daniell. Metallic packing for pistons.
4633 S. Tommis & A. E. Whitwham. Water gauge glass valves.
4680 W. Clark & W. Reid. Flue tubes for steam boilers.
4738 J. P. Wilson. Housing chocks of ships' boats.
4791 F. A. Barton. Diving apparatus.
4798 W. N. Dack & H. B. Barlow. Raising vessels from one canal or waterway to another.
4805 J. Stevens & C. G. Major. Hauling and winding machinery.
4828 A. M. Wood. Life and other boats.
4841 J. Wilson. Ships, barges, bulkheads, &c.
4865 C. A. Barlow. Transferring boats, &c., from one waterway to another.
4875 A. Wilson & J. F. Tafe. Raising and lowering submarine cables.

4932 G. Gilchrist. Thrust blocks of screw propellers.
4941 W. H. Rice. Rowlocks.
4965 F. St. G. Caulfield. Maintaining submerged mines at a given distance under water.
5000 W. M. Swanson. Pontoons or floating docks.
5004 W. Mitchell. Propelling ships or boats.
5033 W. H. Wilson & W. J. Pirrie. Ships.
5051 J. T. Hailwood. Lubricators.
5074 J. Wilson. Ships' barges, &c.
5085 E. Pellas. Balanced lug sail.
5089 J. & A. Campbell. Ships' masts, &c.
5130 A. J. Postans & B. A. Collins. Indicating positions of vessels, &c.
5151 Fell (J. Bowor). Mechanical boiler cleaners.
5157 W. Shapton. Shipping and transferring coal.
5174 A. S. Emin Bey. Ship's rudder.
5176 W. A. Cardwell. Marine and other glasses.
5179 A. H. Walker. A sea oiling cartridge.
5180 A. H. Walker. A sea oiling projectile.
5222 W. Bishop. Ships' signalling lamps.
5223 G. W. Allen and H. J. A. Bowers. Purifying water for boilers.
5225 W. G. Gregory. Counterbalancing centreboards.
5265 R. Wilcox. Operating and controlling torpedoes.
5300 W. H. & T. Fry. Paddle propeller.
5332 Haddan (F. Herbert). Portable and other bridges.
5381 G. T. Haigh & J. Green. Rudders.
5382 G. T. Haigh & J. Green. Signalling between and on navigable vessels.
5402 Mills (L. Bidauld). Ships' propellers.
5407 J. Tarrillion. Boats and propelling same.
5464 F. Crundall. Ships' signal lights.
5493 W. Harvie. Search lights.
5511 T. Woolley. Coating iron ships.
5512 O. E. Pohl. Propellers and steam engines.
5524 F. W. P. Bouverie & W. Balch. Naval signals, &c.
5526 W. H. Hall. Feathering paddle propeller.
5558 B. A. Collins. Torpedo boats.
5559 G. A. Corssen. Torpedo nets.
5584 W. P. Bain. Feathering paddle wheel.
5775 J. H. Carruthers. Pumps.
5787 M. C. Bannister. Ships' bottom coatings.
5788 T. Mudd. Controlling supply of feed water to boilers.
5797 F. Gibert. Paddle wheel.
5800 E. J. Walford. Raising sunken ships, &c.
5829 W. Fairclough. Removing scale, &c., from boilers.
5833 R. Surfleet. Preventing corrosion of propellers.

BOARD OF TRADE EXAMINATIONS.

EXTRA FIRST CLASS.

April 21st, 1888. Simpson, J. A. Extra 1 C. Liverpool.

NOTE.—1 C, denotes First Class; 2 C, Second Class.

March 17th, 1888.

Rothery, Geo. .. 1C Liverpool

March 24th, 1888.

Allan, Robert .. 2C Glasgow
Armstrong, G. R. 1C N.Shields
Blackwood, A... 2C Glasgow
Blake, James .. 2C N.Shields
Bodilly, Stephen. 2C Liverpool
Chicken, Charles 1C Cardiff
Cirft, George T. 1C N.Shields
Clark, Thos..... 2C Glasgow
Coster, John .... 2C N.Shields
Coughlan, T. C.. 2C ,,
Craig, Peter .... 2C Glasgow
Fairbairn, J. E.. 2C N.Shields
Forbes, Thos. .. 2C Glasgow
Foster, W. E. .. 1C London
Hamilton, W. C. 2C Cardiff
Harris, Wm. .. 1C ,,
Henderson, Wm. 1C Glasgow
Hill, J. H. E. .. 2C Cardiff
Hooper, Alfred.. 2C Cardiff
Hoskins, F. W.. 2C ,,
Johns, Joseph .. 1C ,,
Kott, Thomas .. 2C Glasgow
Laundy, Harry . 2C London
Lefevre, Albert .. 1C Cardiff
McArthur, Danl. 1C Glasgow
McGovin, Robt.. 1C Liverpool
Morgan, A. J. ... 2C Cardiff
Morgan, R. F. .. 2C ,,
Mortier, E. E. .. 1C ,,
Nicholson, C. W. S. 1C London
Pringle, Wm. .. 2C Glasgow
Price, Thomas .. 2C Cardiff
Ramsay, J. C. .. 2C N.Shields
Rankine, D. K.. 2C ,,
Ridge, R. W. .. 2C Cardiff
Riley, V. W..... 2C London
Roberts, R. W... 2C Cardiff
Robson, B. .... 2C Glasgow
Rogers, Thomas . 1C Cardiff
Scott, Joseph.... 2C Glasgow
Webster, David . 2C Glasgow
Williams, S. P... 1C N.Shields
Wills, Thos. F. . 1C Cardiff
Wilton, B. B. .. 2C London
Young, James H. 2C Glasgow

March 31st, 1888.

Adamson, James 1C Sunderl'd
Atkinson, Thos. . 1C Hull
Bell, Wm. H. .. 1C Liverpool
Brechin, Alex. .. 2C Aberdeen
Cameron, J. G... 2C ,,
Cook, Alex. .... 1C ,,
Coutts, Wm..... 1C London
Cove, George .. 1C Liverpool
Dodds, Wm..... 2C N.Shields
Edwards, C. A. . 2C Sunderl'd
Ellerington, Wm. 1C ,,
Fenny, John C. . 1C N.Shields
Fielder, Herbert 2C S'h'mpton
Freeman, W. P. 2C Sunderl'd
Gale, Wm. .... 1C Liverpool
Gamble, E. G. .. 1C London
Gerard, Thos. .. 2C N.Shields
Gilroy, T. M. .. 2C Aberdeen
Grey, Edward .. 1C Sunderl'd
Groves, J. W. .. 1C London
Haire, Thomas .. 2C Hull
Hart, Henry.... 2C Sunderl'd
Ingle, Wm. W. . 2C London
Kerton, George . 1C ,,
King, C. Edwd. 2C Aberdeen
McLachlan, D... 1C Liverpool
Millar, David .. 2C N.Shields
Paterson, Hy. C. 2C Liverpool
Potts, Wm. .... 2C N.Shields
Pullar, James .. 2C Aberdeen
Purser, Wm. F. 1C Sunderl'd
Savage, Robert . 1C Liverpool
Scott, Robert A. 1C London
Scrimgeour, D. . 2C Aberdeen
Snook, George .. 2C S'h'mpton
Stanley, Wm. .. 2C London
Sutcliffe, A. H. . 2C Sunderl'd
Waring, John S. 2C Liverpool
Wildish, H. R. . 1C London

April 7th, 1888.

Best, Herbert .. 2C Liverpool
Boulden, Thos... 2C Plymouth
Campbell, James 2C Belfast
Carling, Wm. .. 2C N.Shields
Christie, H.F.W. 2C Glasgow
Dodds, Walter .. 2C Belfast
Doherty, Wm. .. 2C Glasgow
Downie, Wm. .. 2C Liverpool
Dumont, S. .... 2C N.Shields
Edgar, Henry .. 2C Liverpool
Garraway, T. A. 1C Glasgow
Gibson, Peter .. 2C ,,
Glassford, H. .. 2C London
Goodair, R. P. .. 2C Leith
Graham, J. S. .. 2C Liverpool
Greenhill, W. A. 2C Leith
Harris, M..... 2C Cardiff
Heckels, Wm. S. 1C N.Shields
Henderson, A. K. 1C Leith
Holdsworth, A. G. 2C London
Horsburg, Alex. . 1C Leith
Hunter, Robert . 2C Glasgow
Jeffrey, J. R. .. 2C ,,
Jones, Thos. W. 2C Cardiff
Kirkwood, Robt. 1C Greenock
Laidler, Joseph . 2C N.Shields
Leslie, Andrew.. 2C Leith
McAnally, Peter . 2C Glasgow
McDowall, James 1C ,,
Murray, John D. 1C Leith
Nisbet, Matthew 2C Glasgow
Paterson, James 2C Greenock
Sanderson, R. .. 1C N.Shields
Smith, Wm. .... 1C Leith
Thomas, Wm. .. 2C Cardiff
Vickers, Jacob .. 1C Glasgow
Warren, Walter 1C London
Waterworth, H.J. 1C N.Shields
Watson, Chas. E. 2C ,,
Wedlake, W. J.. 1C Cardiff
Whyte, John .. 1C London
Wilson, H. M... 1C ,,
Wright, A. H. .. 1C Cardiff
Wright, John .. 2C Liverpool
Young, John A. 1C Cardiff

April 14th, 1888.

Adamson, R. J. . 1C W.H'pool
Aikman, James . 2C Glasgow
Aitchison, A. .. 1C Liverpool
Barns, Thos. W. 1C W.H'pool
Connell, Thos. .. 2C Liverpool
Courts, W. C. .. 2C Plymouth
Czaikowski, C. J. 2C W.H'pool
Davidson, H. .. 2C Dundee
Dickson, W. F. . 1C Liverpool
Edwards, Thos. . 2C ,,
Elder, John .... 2C Glasgow
Green, Wm. .... 1C Liverpool
Henderson, R. .. 2C W.H'pool
Henderson, F.W. 1C N.Shields
Howe, Wm. .... 2C London
Jennings, George 2C N.Shields
Lush, Edwd. J.. 1C Glasgow
Metcalf, Arthur. 2C Hull
Morison, T. A... 1C Glasgow
Neville, Henry .. 1C Liverpool
Oswald, Richd... 2C Glasgow
Spencer, Herbert 2C Dundee
Stephens, Wm. . 1C Plymouth
Taylor, Robert . 1C Dundee
Thom, David .. 2C London
Thorpe, T. H. .. 1C W.H'pool

April 21st, 1888.

Boyd, James .... 2C Liverpool
Bushell, C. E. .. 2C N.Shields
Carr, Wm. .... 2C Aberdeen
Cannell, John .. 2C Liverpool
Firth, Thos. .... 2C N.Shields
Goodhall, J. R... 1C London
Gough, George.. 1C Cardiff
Hately, J. L. .. 1C London
Hunt, C. F. .. 2C L'nd'nd'ry
Kennedy, J. C. . 1C Liverpool
King, Wm. D... 1C Cardiff
Leonard, J. .... 2C ,,
Lindsay, A. .... 2C London
Mason, C. E..... 2C N.Shields
Mioto, George .. 2C ,,
Mordsay, John.. 1C Cardiff
Paton, Alex. R.. 1C London
Sanderson, Wm. 2C N.Shields
Smith, William . 1C Liverpool
Snaith, Henry .. 1C N.Shields
Standley, T. J... 2C London
Wall, J..... 2C ,,
Wallace, Wm. .. 2C N.Shields
Watt, Chas. C. .. 1C Aberdeen
Watt, Wm. .... 2C Glasgow

MR. WHITNEY, Secretary of the United States Navy, in a letter to the Naval Committee of the House, says that in the opinion of his department it is necessary, as well as economical, that the Government should have a reserve fleet of auxiliary merchant vessels for instant conversion into cruisers in time of war.

The Marine Engineer.

LONDON, JUNE 1, 1888.

EDITORIAL NOTES.

THE "Groveries," as our Glasgow friends have not inappropriately dubbed their splendid exhibition in Kelvin Grove, a valley celebrated in old Scottish song, is now in full swing, and bids fair not only to rival but to far surpass in popularity the best of the South Kensington shows.

That Glasgow has put forward an exhibition well worthy of her fame may be inferred from the fact that it covers three acres more ground than the highly-successful Manchester exhibition of last year did, while its machinery annexe may proudly boast of being larger than that attached to any previous exhibition in London, Paris, Vienna, or elsewhere; and further, the Glasgow authorities are to be congratulated on the fact of their having placed this somewhat noisy, but to all interested in engineering ever welcome, annexe at one end of the building, rather than interspersing it here and there, as has occurred in one or two other exhibitions. There is an air of compactness about this exhibition, rendering all the exhibits easily "get-at-able," which future exhibition committees would do well to imitate, for there is nothing more annoying to a visitor in quest of any particular object than to be directed through a veritable maze of courts, annexes, across the gardens, &c.

From an artistic point of view we doubt not but what the Glasgow buildings, with their glittering domes, and quaint and fantastic turrets and minarets, surpass in picturesqueness all other exhibitions that have preceded it, the view from the hill a little above the university being a singularly striking and pretty one. The grounds vie with the buildings in attractiveness, and ample provision is made for their illumination at night by means of the electric light, the Anglo-American Brush Electric Light Company having installed no less than 519 of their arc lamps in the grounds and buildings.

It is not our province to describe the various exhibits here, but we would call attention to the descriptions of those which will prove most interesting to our readers that will appear elsewhere in this and our following issues. Here it must suffice to say that in the matter of number and also of quality the Glasgow exhibition well holds its own. Perhaps the wonderful popularity of this exhibition, the number of visitors being far in excess of the most sanguine expectations, may be attributed in great measure to the energy, sagacity, and business tact of the managers and their subordinates, who by sheer perseverance had their exhibition and its grounds in a more advanced state a fortnight *before* the opening than many of its predecessors were found to be in on the actual opening day itself.

Another contributory cause to this almost phenomenal success is no doubt to be found in the railway facilities afforded by the different companies. Nothing could exceed the comfort and punctuality afforded by the Midland and Glasgow and South Western route, the journey, by through carriage London to Glasgow, or *vice versâ*, being made in a little over nine hours, deducting the half hour's stop at Normanton for dinner. Couple this with the utmost courtesy received from the officials all along the route, and we think that the railway companies may fairly claim to have helped, in no inconsiderable degree either, in rendering popular the Glasgow Exhibition.

THE craze for exhibitions seems at the present moment worse than ever, though we have heard it repeated by many manufacturing firms that the tax upon their time and attention, not to speak of the expense in providing creditable exhibits for the many and various exhibitions, is becoming very onerous, and yet they do not like to be conspicuous by their absence. However, as far as our particular branch of engineering goes, we think the Anglo-Danish and the Italian Exhibitions may be left considerably out of consideration, though the Italian nation, priding itself on having the next best navy to our own, has sent through its government a very complete set of models of the principal ships in the Italian navy, as also many guns and quick-firing machine guns; but we should consider that to the ordinary visitor the absence of machinery in motion, so common now to all exhibitions, will be somewhat a relief than otherwise. The art metal work exhibited by the Italians might teach us much in the excellence of its workmanship and truly artistic power of its design. In the Glasgow Exhibition, however, seeing that the Clyde is the principal seat of the shipbuilding and marine industries of the United Kingdom, it is not surprising to find that marine exhibits in the shape chiefly of models should form a conspicuous item and of great interest to those connected in any way with these industries. Messrs. W. Denny and Brothers, of Dumbarton, seem to have surpassed themselves in the unusual character and beauty of their varied exhibits. They show all the models of interest that have arisen in the course of their very extensive shipbuilding

trade, from the first steamer built by them, the *Loch Lomond*, dating 1844, to passenger vessels of latest design, of both small and great tonnage, such as the *Jumna* for the British India Steam Navigation Company. We may note that the engines of the *Jumna* are of one of the latest quadruple expansion type, and are so designed and arranged that they are as easy of access as is usual in the case of ordinary compound engines. One of the most striking items, however, of Messrs. Denny's exhibit is a full-size dining saloon and ladies' cabin, consisting of two teak deck-houses, the lower, on the main deck of a supposed ship, containing a dining saloon and ladies' cabin, whilst the upper embraces a music saloon and smoking room, the two being in communication by means of an elaborate staircase. Great care is shown in the general arrangement and style of decoration, which is of the most beautiful character, the lower portion of the saloon being provided with a richly carved dado, and the door panels are beautifully carved and ornamented with inlaid work. The ladies' cabin is decorated in Japanese style, and the upper framing of the panels is embellished by many fine oil paintings. The whole is lighted by electric light, and gives a most realistic and vivid idea of the extreme luxury with which modern passenger vessels are fitted out.

THE nation is just now going through an acute attack of panic as to our national defences. On every side is heard a cry that our defences have suddenly been discovered to be inadequate to sustain an attack from a very small invading nation. It is difficult to see what all the agitation is aiming at. Our army and navy are in about as efficient a condition now, compared with those of other nations, as they used to be in former days, and we have never yet been subjected to the horrors of foreign invasion. In fact, we think our best protection is the difficulty that any invading force would find, both to know what to do when they had succeeded in landing on British shores and how to get out again, with a maritime force threatening their communication across the silver streak. Here, we think, is the pith of the whole matter. To attempt to fortify England all along her coasts in such a way as to prevent the possibility of an invading army being landed anywhere upon her shores, is a project of such magnitude and so hopeless in its completion that we should think it best frankly to accept the situation, and to direct our attention to rendering the crossing of the Channel, or approach to our coasts, a practical impossibility in the face of our maritime power. Or, should that be effected by the evasion of the protecting navy, the invading force would find itself hopelessly cut off from all communication with its native country and with its retreat closed in case of disaster. We do not think that any nation, however self-confident, would care to find itself boxed up in England, in the face of the powerful territorial army that would readily be raised to meet such an emergency, with its retreat cut off in case of disaster and its supplies dependent on what it could raise from the country. Everything therefore would appear to depend upon the organisation, in peace time, of so overwhelming a navy that under all circumstances we shall be able to control the seas. That is our best protection against invasion or against the tempted wresting from us of our various colonies. The undertaking, if sheltered by England alone, seeing that we have need for at least half-a-dozen fleets in as many seas, would be a heavy one; but we have still hopes that the movement, which is steadily increasing year by year, towards Imperial Federation, will arouse the colonies to a full appreciation of the importance in aiding the mother country in the maintenance of an overwhelming navy, and that the efforts of the colonists when so offered will be properly recognised by the home government, and a full and creditable status allowed to such officers and men as may help to form the colonial navy. It is said that, up to the present, Admiralty management has resulted in waste and incompetence and red tape on every side, and that there is a strong feeling among the taxpayers that it is useless to talk of further expense in building more ships while the department appears to be in such confusion. Let the nation once see the management organised, and no longer completed vessels waiting twelve months for their guns before they can be commissioned, and we have no doubt it will be ready to make a move in earnest in the only effective protection that we can see for Great Britain—namely, a rapid increase in the power and efficiency of our navy.

SOME little fuss has been made lately about the long run of a Westinghouse engine, which is stated to have made 233,000,000 of revolutions without stopping during a period of thirteen months. Though this may happen to be by reason of its circumstances a very exceptional result as regards its having run for so long a period without intermission or stoppages, yet we do not think it would be difficult to extract the same performances from a very large proportion of ordinary English-made engines if certain conditions were complied with. The most important of these conditions to our mind is that the

...e should be more lightly loaded, as to which, in the ... Westinghouse engine, we have no particular ... Our reasons for so much insisting upon the ...is point are as follows:—It is generally ...r that would prevent any engine which was ...y stressed from running for such a continuous ...d this wear and tear would be chiefly in the ... and pins of the valve gear, any other cause of ...ge being probably only caused by sudden over-...ress, such as the bending of a connecting or valve rod, the loosening of the pin in the crank shaft, or the getting hot and galling of the bearing from inattention. It would be, we feel sure, perfectly easy to any of our engine builders to construct an engine which, barring unforeseen accidents, should run continuously for a twelvemonth, or two years if running with intervals of stoppage, provided the purchaser did not grumble at the expense of special attention being paid to the hardness and area of the wearing surfaces, nor to the size of the engine required to develop the power so as very likely to stress the working parts. As regards the possibility of fracture, which is seldom recognised as a danger to an engine in ordinary work, this would usually arise from the constant lengthening and shortening or bending of the metal under the working stress which as a rule is constantly reciprocal. The constant bending or stressing in opposite directions of material will in time alter its structure, and is dependent in the rapidity of its change upon the proportion of the strain to the limit of elasticity of the material, hence our insistence as a primary point for long wear of small ratio of stress per section of material. If the Westinghouse engine referred to is a single-acting engine in one or more cylinders this again greatly enhances its chances of long wear without any necessity for stopping for repairs. The most troublesome item for constant repair is the big end brasses of the connecting rod, since the moment they wear slack, a considerable knock is set up which would tend sooner or later to destroy the brasses or even the engine itself, and the engine must be stopped to take up wear and tear. Where the action is single-acting in one direction only, such engines will run without noise though there is $\frac{1}{8}$th of an inch slack between the brasses and the crank pins, since the pressure being all in one direction the connecting rod takes up its own wear. We have little doubt that if some of our readers will look up their records they may find much longer runs effected by engines under their charge without repairs, even though such runs may not be continuous as to time, which we do not think affects the question in any degree. We should be glad to have any information on this point.

DISCUSSION ON FORCED DRAUGHT.

(*Continued from page* 56.)

MR. JAS. HOWDEN: I am hardly prepared to speak upon these papers, seeing that before coming into the room whilst the first paper was being read I knew nothing of the contents. Of course, to go over the whole matter taken up here would be a rather formidable task, and I don't mean to say very much on the subject. There are just one or two points in Mr. Fothergill's paper which I think it is necessary for me to say something upon. He takes up the matter of combustion, and places very little value upon the heating of the air; he says that the increased work upon the fan more than takes away all the benefit of heating the air. Now, this increased work upon the fan I have never been able to realise, or to find out that there was any appreciable increased work upon the fan. If we take a fan supplying air for an engine indicating about 5,400 H.P., and find it is even only a few H.P. (on my system one fan 5 ft. 6 in. in diameter working at 350 revolutions supplies that air), I do not think there is very much to be said about loss upon that fan's work; and to say that the whole gain of heat, which I have endeavoured to take out by my system, is to be a gain in a single h.p. or two, is a very rash statement, I think, and does not at all agree with my experience. In one of the tables Mr. Fothergill gives you will find the heating surfaces set out. I find that the *Stella*, upon which considerable stress has been laid in the paper, has an I.H.P. of 853, and she has two boilers with a total heating surface of 3,498 ft. Everyone acquainted with marine engineering knows that this is an excessive surface for natural draught for 853 H.P. I do not see how the forced draught could have been supplied to those boilers at all as forced draught. And I merely state again here that the blowing in of air to an ashpit, or round about a boiler, to the exclusion of the supply by natural draught to the ashpit (I mean an open ashpit), is not to be considered forced draught at all, and I think it does not bear upon the proper question of forced draught as applied to steam navigation. I think if you are going to apply forced draught at all, you should take the benefit of it and reduce the boilers and increase the power. Here we have got boilers with an excessive heating surface and a very small I.H.P. I would simply say that I do not consider this has any relation to forced draught at all. It is certainly supplying air by artificial means, but it is not forced draught in the proper sense of the word. With regard to the *Marmora*, I see she has got 1,700 sq. ft. of heating surface, with an I.H.P of 396. There again I think it is an unusually small H.P. for such a surface, and I do not look upon that as forced draught. With regard to a statement that Mr. Fothergill made, that the *New York City* had gone away on the 13th October, I would like to say a word. I understand that this application of forced draught was made by Mr. Fothergill after I read my paper here on the 3rd April, 1884. I removed the old boiler from the *New York City*, and refitted a new one which had not had forced draught all these years, and it was tried in September, though the vessel did not sail till the 13th October, as she always did sail on that date. I understand from Mr. Fothergill's reference to some remarks of mine that he had seen in the newspapers, that he claims to have been before me with regard to this forced draught. Now, I think, these are the circumstances of the case. Mr. Fothergill had the advantage of seeing my paper in 1884, and after that he fixed up this boiler. As to this plate of Mr. Fothergill's, I think you will find, if you take my illustration which I published in 1884, that he has got it very nearly followed out here. However, I do not want to introduce that matter before this Institution. That is a matter that may be settled between Mr. Fothergill and myself, but I merely call your attention to it, seeing that he has referred to it in his paper; and, after the two years' previous working, which I described in my paper in 1884, I do not think Mr. Fothergill can claim precedence in the matter of forced draught. With regard to Mr. Soper's paper, I am certainly very pleased to hear that this closed stokehold system is proving much safer and more efficient than what all my experience, and, I think, a great many circumstances in connection with it, would lead one to expect; but I think we can scarcely say that the thing has been properly tried, even in the manner which Mr. Soper described. I think these forced-draught boats should be put on to a power which would prove say 30, or 40, or 50 per cent. above natural draught power; and if they continue to run across the Atlantic without trouble, then after that I fancy that we may say that the closed stokehold has been capable of working forced draught at sea continuously under all circumstances. I am astonished that it has not been tried in this way already. I think that

all the facts that have been referred to by Mr. Soper scarcely carry out such serious trials as working continuously across the Atlantic.

Mr. FRANK MARSHALL—Sir John Hay and gentlemen,—I do not know that I can add very much to the interest of these papers. We are very much indebted to Mr. Fothergill as well as to Mr. Soper for the valuable information that the two papers contain. I think we are specially indebted to Mr. Fothergill for producing a paper containing such very full data of the actual working of merchant vessels. I think we may take it as an accepted fact now that forced draught is a very great advantage for merchant vessels: that you can work boilers as economically under forced draught as you can under natural draught; that you can very considerably reduce the size of your boilers, and therefore save weight by the use of forced draught as compared with natural draught, and that your boilers will endure quite as long under the one as under the other; that the collateral advantages in working forced draught are very great indeed, especially in the matter of cleaning fires; that there is no reason why the vessel should lose her speed; that fires can be cleaned and the vessel maintain her speed during the whole time; and, further, that in hot climates the temperature of stokeholds and the efficiency of the boilers can be maintained during the whole of the passages between here and India, which I need not say to anyone who has been on that route is a very great matter indeed. Having been one of the first (I will not say I was the first) to introduce this matter of forced draught, I will, just by the way, give a few dates. I believe that we may give credit to George Stephenson, in the first instance, for forced draught, and next I think we may say, so far as steam vessels were concerned, that our friend Mr. Thorneycroft had a considerable amount to say on that question long before any of us thought of it, and that Mr. Yarrow also was well to the front. I am not quite sure as to precedency of dates between Mr. Yarrow and Mr. Thorneycroft, but I think I may say that I happen to be the individual who was the means of introducing for the first time forced draught into war vessels of a large power. At the suggestion of Mr. George Rendell, whom you may know in connection with Sir William Armstrong's firm, I had the honour of engining three vessels for the Chinese Government, and those vessels were fitted with forced draught on the open stokehold system. The boilers were made considerably smaller on account of it, and the whole machinery was made of the lightest possible construction; in fact, I believe that so far as weight is concerned the machinery fitted into those Chinese vessels has not been very far exceeded, so far as lightness is concerned, up to the present day. It was in the year 1879 that those cruisers were fitted with forced draught, so I think we may take it as an accepted fact—and I would impress it most earnestly upon all shipowners and superintending engineers here, that it is, and it may be quite accepted as a fact—that forced draught, from whatever point of view you take it, is a very great advantage in the merchant navy. It is quite true that there have been many failures. These failures have arisen partly from a misconception of the principles of forced draught, forgetting altogether the necessities, or rather the chemical conditions, necessary to combustion, and imperfect fittings which have given trouble after the ship has got to sea. Mr. Fothergill has taken the line of leaving what was the first introduction of forced draught. He has taken the line of applying forced draught after Mr. Howden's fashion, to some extent, under the ashpits and direct into the furnaces, leaving open stokeholds. In this I think he is perfectly right. The question of the application of this plan to war vessels and leaving large open hatches has been very carefully and successfully met, I think, by Mr. Soper; but in the case of war vessels you want to have your hatches as small as possible, and therefore there is no disadvantage in closing your stokeholds. As regards the fitting of forced draught to furnaces, I am sorry that I cannot follow Mr. Fothergill quite in the construction of his furnaces. He has told us that carbonic oxide is, in the first instance, generated in a furnace. I believe we are all agreed on that, and that it is necessary that air should be admitted afterwards in order to supply the oxygen for the purpose of conversion into carbonic acid gas. I believe we are all agreed that the furnace in a boiler is the most effective part of the whole heating surface. I therefore do not quite see the advantage of admitting air in the way Mr. Fothergill proposes. If the carbonic oxide is to be converted into carbonic acid gas, the sooner it is done the better, and the intensity of the furnace currents could be enormously increased, to very nearly eight times the temperature, if that operation is effected at the other end. Therefore, I think it rather a disadvantage to Mr. Fothergill, if he will excuse my saying so, to admit the air at the place he has shown. If possible, at whatever cost, I should endeavour to make it up—I say that because I see you will have to work it up yet—to find some means of getting the air applied at the bridge. I think a better result would be obtained by lengthening these bars, and having the bars so arranged that you can take a large quantity of air through the fuel, and a larger proportion of air at the back than Mr. Fothergill proposes. That, of course, is a matter of opinion and experience. Mr. Fothergill has had very satisfactory results with his plans, but I suggest that a better result, in my opinion, would accrue from having less air at the after end. Further, I fail to see how those air boxes are going to bear the heat; it seems to me that they would rapidly wear away, and especially that this deflecting plate would very soon be found in the bottom of the ashpit. Of course there is no reason why the deflecting plate should not be made of fire-brick instead of iron. I do not know that I have anything further to say, except with regard to Mr. Soper's very valuable report as to the effect of forced draught upon the boilers of Her Majesty's Navy. I am sure the results are extremely gratifying. It has been with all of us a matter of very serious consideration how the boilers would stand the application of forced draught in this way, and we find here from Mr. Soper that they have stood the work remarkably well. I may say that as the result of my own experience with boilers of a slightly different form than those of the *Rattlesnake*, constructed by our friend Mr. Davis, but boilers that have been subjected to a very great amount of very hard work in the Italian Navy, they have now been at work 15 to 18 months, and up to this hour have never given the slightest trouble in the shape of leaky tubes, or difficulty with the furnaces, or in any other way whatever. And I should say that those boilers are working in batches of six and four. In the case of one vessel with locomotive boilers of that type, the whole of last summer she was working with continuous steaming, and there was not the slightest difficulty in any shape or way. Therefore I think we may safely say that, so far as forced draught is concerned, we may accept it as a very valuable auxiliary in navigation. Sir John Hay has called my attention to a part of Mr. Soper's paper in which he mentions a very important fact. Mr. Soper says that in the boilers fitted to the *Orlando* and *Undaunted*, the *Narcissus* and the *Immortalité*, by their respective builders, "there is one combustion chamber to each opposite pair of furnaces, that is, three combustion chambers, with waterways running fore and aft the boilers between them. In the *Australia* and *Galatea* there is one combustion chamber only to the six furnaces. The results obtained by the single combustion chamber boiler are superior to the others," to the extent of practically 9,400 I.H.P., as against 9,000 in the *Orlando*, the *Undaunted*, the *Narcissus*, and the *Immortalité*. Well, that is a very important and impressive fact, and confirms to some extent the experience that I have had on more than one occasion. About eighteen years ago I fitted two vessels for the Guion Line (built by Messrs. Palmer) with boilers which, for their deadweight, were supposed to be the largest that had then been built; I am quite sure they were the first boilers that were ever built with 1¼ in. plates, and they were 16 ft. 6 in. diameter, and 19 ft. 6 in. long, with five furnaces in each end, the whole of the furnaces debouching into one combustion chamber. The exact details I have not with me at the moment, but the results that those boilers gave were very satisfactory indeed as regards combustion of fuel and the power developed. One very important circumstance that I may mention is the fact that the year before last, when I had the pleasure of seeing our late esteemed friend, Mr. Guion, in Liverpool, he said, "Those boilers are as good to-day as the day they were put on board." This fact, coming before us to-day, I consider a very important one indeed. It tells its own tale in the shape of the desirability of our giving very large capacity for the devolution of the gases from the furnaces, and that they should not be confined and restricted in narrow combustion chambers behind. Our friend Mr. Alfred Holt, of Liverpool, has for very long constructed his boilers on this principle, leaving one very large combustion chamber in the centre, between the furnaces and the two ends of the boilers; and he has had, I believe, more satisfactory results from those vessels than almost from any others. The reason why we resort very often to separate combustion chambers is that we do get the advantage of increased heating surface, with perhaps a little smaller boiler, and it cannot be said that the game is not worth the candle; and it would be better, according to the results here given, if the single combustion chamber for the whole of the furnaces from each end of the boiler were adopted. The fact that such a very large increase of power results is of the greatest importance, and I am told that this is not entirely what might have been done, but that had the engines been larger more steam still could have been generated from the boilers; but the boilers were not worked up to their full power even under the circumstances—a very important fact.

Mr. LYMINGTON—There has been some little dispute in the history or at least the date of the introduction of this closed ashpit system. Perhaps you will allow me to say, although it is before my time, that looking through an old book one day I came across the fact that at the time when fine boilers were superseded by tubular boilers, several of them had far too much tube service, and consequently they could not get a proper draught, the temperature in the funnel was not sufficiently high; and in some cases fans were fitted to blow into the ashpit. That was, I think, really this ashpit system; and that is some thirty or thirty-five years ago. Now, at the commencement of Mr. Fothergill's paper there is a point to which I should like to take a little exception. He says he is of the opinion that in the general application of forced draught to the mercantile marine (more especially to cargo steamers) the "closed ashpit" system offers advantages not possessed by the system of "closed stokehole." I think that is very much a matter as to how many boilers you have in the ship. If you have one boiler, and it is in the same compartment as the stokehole and the engine, to get a closed stokehole means running into a good deal of casing; but when you have a large number of boilers, as you have in some large ships, with perhaps 12 or 18 furnaces in one compartment, it seems to me to be simplicity itself to close in the stokehole; that is to say, to put a comparatively tight casing in the funnel hatch: then you could put the fans on the deck, with an aperture on the deck for blowing into the stokehole. It seems to me that an arrangement of that sort is simplicity itself compared with an arrangement where you have some 20 or 40 valves, with lots of casing all round. I may say that if there is any idea that there is any trouble with air loops or anything of that sort, of course all those difficulties, if there ever were any, have long since been overcome. The advantage of this arrangement appears to be the arrangement of blowing the air into the back of the combustion chamber. There is a paragraph in the paper in connection with that, which I have been trying very hard to understand, and, if you will allow me, I will just read it. "The air leaves the fan at 3 to 3½ in. water-gauge pressure, and in its passage to the furnace is supplied to the casing at the back of the boiler, which, due to the size of this casing, and the deflecting scoop, the pressure is maintained, and the air enters the tubes through the boiler back at the same pressure as it leaves the fan," that is to say, as I understand it, you get 3½ in. of air pressure at the fan, and therefore I should suppose you get 3½ in. of air pressure in the tubes.

Mr. FOTHERGILL—No, no, it is in the back of the tube; that is a pipe that runs along the side.

Mr. LYMINGTON—Of course it is quite certain that the air pressure in this part must be much lower than it is in front. Experiments have been made, and it has always been found that the pressure of air *here* is say 1½ in., and the pressure *here* would be say ¼ in. With respect to this arrangement at the back, I have no doubt Mr. Fothergill has a good reason for it, and if he could favour us with any results with this blowing air at the back in operation, and with the valve closed, I think we should all be very much interested in it. It has been pointed out, I think, in Mr. Soper's paper, that where boilers were used for distilling purposes and there was a good deal of scale got on the tube plates, there was a little weeping at the end of the tubes. Now in a case like this (and I see it is also in Mr. Yarrow's boilers) having the pressure far away from the tubes is much more favourable to the tube ends. Of course in our naval boilers we put the fire grate back, and the consequence is that the tube ends are much more tried by the temperature than they are right away up at the other end, and it passes over a considerable amount of heating surface (and the most efficient heating surface) before it comes to the tubes. Of course, now that we do not use steam from the boiler exactly for distilling, now that we have the double distillers that Mr. Soper has referred to, all that trouble has passed away. The success of the forced draught, as far as the boiler goes, is the matter of keeping it quite clear. Some reference has been made to the large combustion chambers. Of course it has always been said from the earliest days in which combustion was considered, that large combustion chambers were of great value, and where your circumstances allow you to put the fires so far forward, as to give you half the furnace, and the remainder for the combustion chambers—practically one large combustion chamber—I think that is extremely favourable to economy; only, of course, sometimes circumstances will not allow you to fit the furnace in that way; and for anyone fitting it for the sole purpose of economy I think it would be of very great advantage to put the fire-bars say half an inch from the furnace, so as to have as much combustion chamber as possible. I don't know that I have any more to say, except that I am sure everyone must feel very great pleasure in learning that this system has turned out a great commercial success.

Mr. PARKER—I regret that I have not had an opportunity of reading Mr. Fothergill's paper, although it was at my suggestion that he wrote it. As I have not been present when he read it I can hardly be expected to go through all the different points in the paper; but with your permission I will state to you what has been done in the mercantile marine so far as I know in this particular direction. Up to the present time there have been some sixteen vessels fitted with a system of forced draught and the majority of those I am bound to say on Mr. Howden's principle. Five of those vessels have had that system of forced draught taken out of them because for some reason which I will endeavour to explain it has not given satisfaction. The other vessels are now trading, some to India, others to America, and doing perfectly satisfactorily. Those that have failed are those vessels belonging to owners who have contracted with the engineers who undertook to fix this forced draught, and in the first voyage that they made, seeing that it was not as great a success as they anticipated, immediately ordered it to be taken out. Those that have succeeded have persevered with it. In every instance where they have persevered and regulated the proper amount of air necessary for perfect combustion, they have, in every instance, been perfect successes. Now, in the case of the steamers that are crossing the Atlantic working under forced draught, I refer first of all (and it is of great importance) to the *New York City*, because certainly that vessel has been working now for five years under forced draught with half the grate area that she would have had if she had been under natural draught, and no deterioration whatever can be perceived either externally or internally in those boilers which are working under this high rate of combustion. That, I think, gentlemen, is one very satisfactory point in connection with this subject of forced draught. Now the other vessels that are working are vessels trading to India, in very hot climates, and where they have to use water at a very high density. Again, in the Atlantic trade there are vessels that have been converted from ordinary natural draught to forced draught for the purpose of experimenting. I take the case of the *Ohio*, on which vessel some £5,000 or £6,000 was spent in the provision of forced draught alone, for the purpose of satisfying the Inman and International Steam Navigation Company whether it would be wise in constructing these large steamers that they are making now on the principle of obtaining the speed that they expect to attain by the means of forced draught. Again, in the case of the *Celtic*, of the White Star Line, that vessel, which had ten boilers originally, had some £5,000 or £6,000 spent upon her for the purpose of obtaining experimental data with a view of finding out whether in the new ships that Harland & Wolff are to build for the White Star Company they should depend upon forced draught for their high rate of speed. In the case of the *Ohio*, the first voyages that she made across the Atlantic were altogether unsatisfactory. She did not make anything like the proper passage, she could not keep steam, the system of forced draught was a complete failure; but the owners persevered and spent more money, altered the areas of the ports that admitted the air, gave them a greater or less amount of air as was considered necessary, until they arrived at the proper rate of combustion that was necessary, and then she became a success. In the case of the *Celtic* it was somewhat similar, but now the *Celtic* is running with eight boilers instead of ten, and doing far more work and far better work than she did with the ten boilers, under a moderate amount of forced draught. That represents in that ship the space occupied by more than two extra boilers, which represents about 260 tons of cargo. I have no hesitation in saying to this meeting, that, from the experience thus obtained, the White Star Company and the Inman and International have designed and are building their steamers to work under forced draught to obtain the maximum speed they expect to get. Gentlemen, I do not think there is anything further to say on this subject, except that I think that this system of forced draught is really the next great improvement that we shall witness in marine engineering. It should be carefully watched, and anyone who is willing to spend money in the use of forced draught should be encouraged to the utmost degree.

Mr. KIRK—I have perhaps said as much to-day as I ought to say. I shall not pretend for one moment to dissect Mr. Fothergill's paper. His statistics are most valuable, but they will be done better justice to in the study than they can be here. Speaking, however, of forced draught generally, we must distinguish distinctly between the case of the Admiralty and the case of merchant ships. In the Admiralty the object is on an emergency, at whatever expense of fuel perhaps it may be, but on an emer-

gency, to secure the very greatest power that can be got out of the weight of machinery that your ship can float; and under those conditions much higher rates of combustion have been achieved than I find indicated here in Mr. Fothergill's paper. Apparently Mr. Fothergill has worked from ½ in. to ¾ in. of working pressure. Now the working pressure at the Admiralty is 2 in., and we must not compare the results got under two such opposite limits of working as if they were all one and the same thing, simply because in both cases it is forced blast. In the merchant steamer I can very easily understand that at ½ in. to ¾ in. of water pressure there should be no difficulty with the boilers whatever. It is a little more than you can get by a high chimney, but certainly not any more than you get by a good high brick chimney in a land boiler. At the same time there is no doubt that the getting of that on board a merchant ship is a good step. We have the evidence of Mr. Parker as to the reduced space occupied by the boilers. I do not know at what air pressure they were worked in that case.

Mr. PARKER—Something under ½ in.

Mr. KIRK—Well, even under these very moderate limits we find that the space occupied was reduced by the difference between ten and eight boilers, which is of course a very valuable gain to the shipowner; and, even if his boilers should last only a year or two less, I believe it is still a very profitable speculation for him. However, that is his business. But in the case of the Admiralty boilers even going up to 2 in. of water pressure, where the boilers have been managed with any reasonable care, they have stood the test, and that for a lengthened period too, quite successfully. So that the merchant shipowner just now has a very large margin—perhaps I ought not to call it a "factor of safety" (laughter)—he has a very large margin before he gets up to the dangerous limit, as some think, of our Admiralty friends' working. With reference to the advantages of a combustion chamber, first of all let me remark that I think it is a thing which has long been known in the profession that, the smaller the grate you can burn your quantity of coal on in a given boiler, the more economical will be your working. There may be other points, about clinkers and cleaning fires, and so on, which I do not deal with. I think all of us who know much about it, when we have had a trial trip have reduced our grate to the smallest size, even under natural draught, that will do the work; but the effect here is to reduce the grate by one third, I dare say, of what the original grate was.

Mr. FOTHERGILL—Fifty per cent.

Mr. KIRK—I am not prepared to admit that the advantage has been got by the increased capacity of the combustion chamber. We certainly require to get the gases and air to mingle as quickly as they can, and while the gases are hot; and the point is to get them mingled; and I am not aware that great capacity is a point really of further importance. No doubt the single combustion chambers in the *Galatea* were a very good thing, and as Mr. Soper has pointed out, they fulfilled the purposes they were intended for very well indeed, but that was not altogether on account of their cubic capacity, but because they allowed of a better admixture of gases, and they prevented the cold current of air that went in when the door was opened from having its effects neutralized; the cold air was diffused amongst the hot gases coming from the other furnaces; but whether the engine was too small for the boilers or the boilers too large for the engines is a point perhaps not worth discussing. At any rate the whole machine was within the weight given, and the whole of the steam was passed entirely through the high pressure cylinder, no auxiliary admission to second or third cylinders being required.

Mr. R. SENNETT—Sir John Hay and gentlemen, I do not at this hour intend to occupy much time, but I think it is perhaps desirable, as the Admiralty practice has been referred to, that I should add a few words before the discussion closes. I think perhaps the term that is applied to this system of supplying air to the furnaces, "forced draught," sometimes leads to a misapprehension of what is meant. All draught is forced draught in a sense; we either have to pull it down by a chimney, or blow it down by means of fans. In the system we are discussing to-night, it is simply blown down by fans instead of being drawn down by a chimney. This question has to be looked at under two aspects. One is, the boiler may be regarded in one sense as an apparatus for burning coal economically, and under that aspect it is very probable—in fact, I may say there is no doubt—that the closed ashpit system as shown by Mr. Fothergill (and, as Mr. Fothergill points out, it has been in use for a great number of years under different forms) is a good system and tends to promote economy. But there is another aspect in which this question must be looked at, and that is, the boiler must be considered as an apparatus for generating steam, and generally the greatest quantity of steam that is possible; and I am quite certain that, from that point of view, there is no system yet in practice, or yet proposed, that gives anything like the results that we have obtained and do obtain every day from the closed stokehold system. Of course, the conditions for the merchant marine are very different from those for war ships, and in those cases that Mr. Parker has told us about, those most satisfactory cases of ships going constantly across the Atlantic with closed ashpits, and with somewhat reduced boilers, and with very economical results, those cases are very satisfactory evidences of what has been done with the closed ashpit in the mercantile marine. But I find that in this ship, the *Etna*, that has been referred to by Mr. Fothergill, the H.P. obtained from the boiler was 485. Under war-ship conditions we should have to get at least 1200 H.P. out of the same boiler. Mr. Kirk also called attention to the very moderate air pressures at which these boilers should work—½ in. to ¾ in. Mr. Inglis told me when I was sitting by his side just now, that in his factory boiler, with a chimney stack, they had a pressure of ⅝ in. I think Mr. Parker said that in those ships with closed ash pits they worked to ½ in. or ¾ in. Well, with that moderate air pressure there is no doubt whatever that boilers in closed stokeholds will work as long as ever the coal will last. The conditions of working are very moderate ones, and there is nothing under those conditions to interfere in any way with the durability or satisfactory working of the boilers. Mr. Soper has called attention to the satisfactory use of this system in the Royal Navy. Mr. Marshall said that as far back as 1879 he fitted steamers of this sort for the Chinese Government. I presume they are going on still; I have not any opportunity of knowing. We know now it is not a case of supposition—we know from actual experience that the system is perfectly satisfactory and perfectly durable. The principal objections that have been raised to it have, fortunately for the system, been raised by gentlemen who have not had much practical experience of it.

Mr. SCOTT—I rise simply to refer, in a single sentence, to what has fallen from my friend, Mr. Parker. If I understood him aright, he stated that there were only sixteen ships in the mercantile marine fitted with forced draught, five of which had been withdrawn. I do not know whether I correctly heard him, but I think he must have intended to say that there were sixteen ships which had come under the cognizance of the Society over which he so ably presides; because it is within my knowledge that there is a fleet—the one to which Mr. Marshall referred when he was criticising the question of single stokeholds—that of Mr. Alfred Holt, of Liverpool, in which, if I am not mistaken, there are six ships working, and those ships are all working on the closed stokehold system—I mean that adopted in the Government, which seems to differ from that which Mr. Parker has brought under our notice. I understand the endeavour of the owners of those ships has been, not to save coal, but to burn the same quantity of coal which they did before they adopted the forced draught system, and they have made a number of experiments practically, through long voyages, of the necessary area and the necessary amount of water pressure with which to attain that object in the best manner. I understand that they have succeeded in doing so, all of the boilers being of the type to which Mr. Marshall referred, with a single large stokehold, but cut up by vertical pipes to give circulation of the water in the boiler; and that the results have been eminently satisfactory as far as regards the speed obtained from the same consumption of coal which they formerly used. There is one point which is referred to in Mr. Soper's paper which I am aware is fully borne out by the practice in the mercantile marine, and that is the statement which he makes as to the comfort experienced by the stokers in the closed stokehold system. I believe that in the Holt fleet there is a very large amount of competition amongst the stokers of that fleet as to who will go in the forced-draught ships, which shows, I think, that the men experience a great amount of comfort in Indian voyages with those vessels, presumably from the adoption of the system taken up in the Navy. It is certainly of very high use (although neither economy nor extra speed may be obtained at any given moment) in obtaining regularity of voyage during the monsoon season, when trading steamers of moderate speed have frequently to labour under great difficulties in performing their voyages at the speed of the wind with which they are travelling.

Mr. MUDD—Sir John Hay and gentlemen, I cannot claim to have any special experience in forced draught, and, therefore, what little I shall say will be rather in the nature of a suggestion than anything else. I happen, however, to be a fellow-townsman of Mr. Fothergill's, and have had opportunity on several occasions of being present on board his steamers when his forced draught

has been in operation, and I may say that I think the figures he has given may be implicitly relied upon, if that is any advantage. I think the great points that Mr. Fothergill relies upon for the exceptional efficiency he seems to have attained are the shortening sufficiently of the firebars and the introduction of the air at what he considers to be the right place. Now, these two points, and the putting in of his deflector, curiously enough happen to be the very points that Mr. Marshall has suggested are probably wrong. Of course we must not forget Mr. Marshall's experience enables him to speak with very great authority upon these matters; but, perhaps, after all, the two views may be reconciled, and it may be interesting to endeavour to reconcile them. Mr. Marshall's reason for suggesting that the firebars might with advantage be lengthened, and the air introduced more safely at the bridge, or at the back instead of the front. I understood him to be that all engineers agree that that is the most effective heating surface in the boiler. Well, may it not be that the radiant heat from the incandescent fuel is sufficient without the whole of the gases being effectively consumed at this point to render this surface highly efficient as a heating surface, and that the introduction of air further back may again render the heating surface further on in the boiler also highly efficient? This deflector appears to me to be a very important part of this system, because without it the heat would escape without coming in contact with the air introduced *here*; and although that has been very naturally objected to by Mr. Marshall, inasmuch as if it were made of iron it would probably soon have gone to the bottom, and if made of fire-clay or fire-brick it would have other disadvantages, inasmuch as it would retain the heat after the steam went down, and so forth; possibly some other material, such as a curtain of asbestos, or something of that kind, might be hung there and answer the purpose without having those disadvantages. I think we should not overlook the fact that by introducing the air here, and keeping the fire-bars short, a large amount of surface in this part of the furnace is exposed to a higher temperature for the gases, and possibly the dead-water (as we are in the habit of calling it) in the bottom of the boiler is prevented from existing to so large an extent as usual. There is one thing I regret more particularly than anything else in the paper, and that is that Mr. Fothergill has said he cannot give us any definite rule for the fire-grate. At the same time I think, from what I know of his views, that he regards that as perhaps the vital point in his system. If he cannot give us any definite rule, I wish he would give us something at all events, if it is only general.

Admiral De Horsey—It may be interesting to two of the gentlemen who have suggested that the deflector would probably be found in the bottom of the ashpit, to know that I have tried it with a large steam launch, where I found that the tubes were so constantly coming out I put an iron deflector, and, exactly as these gentlemen have said, it did find its way to the bottom of the ashpit once a month; but I found it pay me to replace it once a month, it was so beneficial in that case for saving the tubes. There is one thing I should wish to ask Mr. Fothergill, if he would kindly explain when he replies, and that is this. He informs us that the theoretical amount of air for the combustion is, I think, something like 10lbs. to the pound of coal; but that under the ordinary amount of draught without forced air, there is about 20lbs. of air to the pound of coal, that is 10lbs. more than the theoretical amount, which I understood him to say was injurious. Well, under the forced draught it stands to reason that still more air must come in unless you check its outlet; and I want Mr. Fothergill to be good enough to explain to me, in my ignorance, if he does not lay great stress on the funnel damper as the one thing that makes the difference between the forced air working to advantage or to a disadvantage; for we have heard this evening most interesting statements of the forced air in some ships proving so beneficial, and in others proving so deleterious. I am curious to know whether the funnel damper has not a great deal to do with that.

Mr. Frank Marshall — I only wish to add a word with reference to a remark that Mr. Parker made, that only 16 vessels had been fitted with forced-draught in the mercantile marine. I may say that in one company alone, in the Floria Rubetino Company of Italy there are 30 vessels working continuously on the Ferrando system of forced draught, which is a system, as many of you are aware, very much the same as this represented by Mr. Fothergill, with the exception that the furnace bars are placed transversely instead of longitudinally as shown. The Company were so persuaded of the advantages of fitting all their vessels with forced draught that in the case of re-engining two vessels, the *Cambia* and the *Malta*, which had previously indicated something like 600 to 800 H.P., we put in triple expansion engines with two double-ended boilers of like weight and occupying precisely the same space as the previous compound engines had occupied, and instead of these vessels running, as they used to do regularly, at from 10¾ to 11 knots, never exceeding 11¾, even on forced trials, they now regularly do their journey from Naples to Malta at from 13¼ to 14 knots.

Mr. Bevis—I should like to say a word with reference to what has been said about the number of vessels which have adopted forced draught, as I have been very much mixed up with the Holyhead mail boats. There are five steamers between Holyhead and Kingstown which were all fitted with forced draught on the closed stokehold system, and we have every evidence from Mr. Watson, the managing director, who says he is perfectly satisfied with the result, and I believe those that were altered are working somewhat more economically than they did before. I might also add that there was one small vessel that I was connected with. She was rather short of steam, and we put her bulkhead between the engines and the boilers, and practically made the closed stokehold, and drew the air out of the engine room and forced it into the stokehold, with a most satisfactory result. I think the additional power obtained was something like 30 per cent.

Mr. Beaumont—I should like, before the reply upon the discussion is given by the authors, to ask one question, upon the question of the quantity of air that is used under the system advocated by Mr. Fothergill. In the introductory part of his paper he enters at some length into the question of the quantity theoretically required, and he concludes that part of his subject by simply saying that with the forced draught system all questions relating to the quantity and regulation of air can be adjusted at will. I should like to know, and I think it is pertinent to the subject under discussion, whether any measurements have been made as to the quantity of air actually used under the system he advocates. I know that it has not always proved necessary to the most economical results that the smallest possible quantity of air should be used, and the results of some large number of experiments carried out only a few months ago showed that some of the boilers, all of locomotive type, gave much higher results with what one might call the mean quantity of air, than others did with the smallest quantity of air. So that in relation to this question it would be, I think, of some interest to know what quantity of air has been used in these different cases.

Mr. Fothergill—Relative to Mr. Howden's remark, so far as the heating of air is concerned, I think Mr. Howden did not quite exactly catch what I wished to imply in the paper. I did not wish to convey that the whole extra expense was a question of driving the air due to the increasing of the air by the heat, or the question entirely of driving the air around or through tubes to heat it. A very interesting paper was read at Newcastle by Mr. Spence, upon some trials that were made by the firm of Mr. Marshall's, and Mr. Spence there tried the heating of the air at various degrees and at very high temperatures, and as a matter of fact I think, if I remember right, 4 per cent. was about all they could get out of it, and in the matter of cost the game certainly was not worth the candle. That is the only argument I use. I do not say that there is no gain in it: I fully admit that there is a gain, and every unit of heat that you gain from the waste gases and return to the funnel must be of advantage: I simply say, is it worth the cost? If it is, then decidedly adopt it. Mr. Howden also referred to the large heating surface of these boilers. Well, these are boilers of the ordinary design in the mercantile marine; they are built by well-known firms; and there is simply the ordinary amount of heating surface. I particularly pointed out in the paper "that the boilers are not in any way specially designed for forced draught or in any respect different to the generality of marine boilers." In the seven instances I have quoted, in each case the ship was fitted with forced draught on the ordinary design and the ordinary boiler; and what I intended to show was that there is a commercial value of some moment—a commercial gain, in altering the present existing boilers. If it was a question of designing a special boiler for forced draught, I certainly should not put that boiler in; but that is a boiler that has been running for some four years in the ship, and there we applied forced draught to it. That is a *facsimile* of the *Dania's* boiler. You have got the result on the tables, and there we get, on that footing, a gain of £256 per annum. The fact is, that saving is on the whole consumption—on the whole of the voyage. Now, the saving due to forced draught is only that in the boiler itself; but here we have taken it on the consumption for all purposes, so that it might not be said that more ought to have been apportioned to the donkey boiler, or anything of that kind. We have taken it on the whole amount used, for every purpose, on board the ship, and in that case the cost of that appa-

ratus is about paid for in twelve months' running. Mr. Howden also objects to the term "forced draught." Well, I do not care whether you call it "forced draught" or anything else; it appears to me absolutely immaterial. The draught is supplied under mechanical pressure: by supplying that draught under mechanical pressure we have got a gain. If you like to call it "increased natural draught," or by any other term, I do not know that there is any objection; it is only a question what it may be called. As a matter of fact it is forced in by a fan, and that being so, it appears to me it is forced draught. Now Mr. Marshall appeared very much afraid that these baffles will not stand the work. In this same boiler those baffles have been in twelve months with constant running, and they are as good to-day as the day they were put in. As for this deflector, I admit we have had great difficulty with it. Mr. Mudd suggested asbestos screens. He kindly suggested them to me some time ago, and we tried them; but they would not stand it, and we had to give them up. We tried fire-clay, but it was of no use unless you put it in heavy, and then there was the risk of always having a heavy body of brick intensely hot, especially if you got into port and wanted to get the water out of your boilers; and it was very much in the way. Now we tried various cements that are made especially to stand heat; but we had to give them all up, because there is an accumulation of clinker which is very great. What we do now is to take ship's plates, very old plates, about $\frac{3}{8}$ or $\frac{1}{2}$ in. thick, and cut them up and let them burn away. They run for a month or six weeks or more (and there are few steamers running for more than six weeks), and if you have to renew them they cost you nothing. They are as cheap as can be; you can buy scrap at a very low figure. Then Mr. Marshall also raised the question, which I think Mr. Mudd fairly answered, relative to the length of the bars. Now this question is of great importance, and I had reasons for not putting it in this paper, because we know from many experiments and from practice that it is really a matter of difficulty to say what the length of the bars shall be; it depends a great deal on the fuel, on where the ship is going, and her possible trade; but in one case we had a remarkable experience; we had the bars of a certain length, and we found there was a difficulty in getting steam; the men were constantly at work and they could not get it. The engineer said, "Well, you have reduced the grate too much, we cannot get the steam." We reduced the grate another 4 in. and she steamed easily! In round figures, roughly speaking, the grates were reduced somewhere about 46 per cent., and we are getting a consumption of about 26 lbs. to 30 lbs. per square foot of grate. As for the closed stokehold system, I am not prepared to say much about it, so far as reference has been made to it in the Navy; that I know nothing about, and Mr. Soper no doubt is fully versed in that matter, but, so far as the mercantile marine is concerned, if you were building a new ship and you fully considered the whole question, and you had many boilers, then there might be a question as to how far perhaps the closed stokehold system might be desirable; but after all I think it is a great deal a question of cost. There is always difficulty relative to opening your fire-door and a big rush of cold air going in, but I think to fit in an arrangement of this description is much cheaper, and, for the mercantile marine, we *must* consider the question of cost. Now, I think the question of cost is a very much greater consideration in regard to a closed stokehold system generally, and it is just another question whether you will not require more men to work the closed stokehold system. I am not sufficiently conversant with it to say definitely, but I am under the impression that the number of men required would be different in the mercantile marine (of course I am alluding to cargo boats); I do not think the same number of men would do the same work in the closed stokehold, where you have the closed ashpit. One gentleman alluded to the number of valves in the front of the boiler. There are only three valves in the front of the boiler, and they are worked with a latch; they are simply automatic; as you move the valve to close it the air is shut off. Mr. Lymington said something about 36 or 40 valves—it quite frightened me. There are valves at the back for letting the air in, you place them in one position, which you judge of from your temperature, and there leave them. I admit that the air should be supplied with reference to the quality of the fire, but that cannot always be done; at one time perhaps they get a little too much air, and at another they do not get quite plenty.

Mr. LYMINGTON—When I spoke about 30 valves, I was speaking of where there are perhaps 30 furnaces in one compartment.

Mr. FOTHERGILL—I beg pardon; I thought perhaps you referred to the drawings; I did not quite understand you. Now, Mr. Sennett, I think, alluded to the question of the height of a chimney being similar to the question of forced draught. I am very sorry that I cannot agree with Mr. Sennett, because he is such an able authority that I feel very nervous in saying anything on the question; but I think, if Mr. Sennett reflects, he will consider that in the question of lengthening a chimney you produce a greater draught according to the greater velocity of your gases going up the chimney. Now, one of the first advantages of forced draught, as I pointed out in the paper, is being able to put your damper in such a position that you keep the velocities of those gases down to a minimum; and that you certainly cannot do with any system of induced draught or of lengthening a chimney, and that is a very important point. Admiral De Horsey referred to that, but if he looks at my paper he will see that I dwell very strongly on that position of the funnel damper. In nearly all these boats we have had the funnel damper more than half closed, and unless we do that we cannot stop the velocity of those gases, and we cannot get the results. Then, relative to the air pressures in the ashpits. To some extent that must depend upon the quality of the coal; it must depend also upon the size of your furnace. You cannot put your firebars down too low, otherwise there is the danger that you will get your ashpits choked or burnt; and you cannot get your fires too thick, and therefore your air pressure must be governed, to some extent, by those conditions. In the locomotive type of boilers, where you can get immensely thick fires, you can run your ashpit up very greatly; but if it is regarded as a question of economy, we certainly find from experience that, if we exceed, say, ·7, or $\frac{3}{4}$ in. of water-gauge pressure, we do not get the same pressure as if we ran about that. Now, I understood that Mr. Marshall alluded to the question of the admission of air at the back instead of at the front.

Mr. MARSHALL—Or at the bridge.

Mr. FOTHERGILL—So far as the admission of air at the bridge is concerned, I think that has been tried over and over again, and it will not stand the work—either the holes fill up with clinkers, or the plates burn away, and you cannot have the air admitted in thin streams. Now, if you do not do that you certainly do not get any gain. If you admit the air in volume or in sheet you cool the gases and get no gain; the very essence of it is to admit it in very fine streams. If you admit the air in front of the furnace, on long voyages those baffles get burned—we cannot prevent it—and the air then comes in somewhat in bulk, and of course we then get too much air, and it does not come in in streams, which, after all, is the point. And again, if the air is admitted there, unless you deflect it, unless you have the holes through the baffles at an angle, so as to converge the air to a focus on to the fire, there is a very great probability of the air running along the furnace crown, and you have great chilling and loss. We find we get greater advantage from admitting the air at the back than we do from admitting it at the front. When you are steaming at sea, if you have smoke you close that air at once, and you have a perceptible fall in your funnel pyrometer. Open it, and put it in a certain position, and at once you get your best funnel temperature, and there let it remain. Perhaps you can vary it occasionally, but what I mean to say is, there is no attention required to the admission of air so far as the regulating of valves is concerned—the operation of the valve is entirely automatic by closing the handle. One gentleman alluded to the quantity of air admitted. There is some difficulty in stating it definitely, and getting at it accurately, because there is always a percentage of loss. We can know exactly the quantity of air that leaves the fan, but that is not to say that the whole of that air goes into the furnace. Putting it in round figures, I may say that we lose somewhere about 18 lbs. of air per pound of coal. I simply put that in round figures. I think I have alluded to the principal points raised, and I thank the meeting very much indeed for the manner in which they have received the paper.

Mr. JOHN PRICE—I must apologise for interfering at this period, but I had not the pleasure of being present while Mr. Soper's paper was being read, and I had not got the paper in my possession beforehand, and it is only while I have been sitting here within the last few minutes that I discovered in Mr. Soper's paper an observation which tends to place one or two of the vessels named in his table at a disadvantage unless an explanation is offered; and it is for that purpose only that I rise. He says:—"Each boiler is fitted with six furnaces, three at each end; in the *Orlando* and *Undaunted*, by Palmer's Company, and the *Narcissus* and *Immortalité*, by Earle's Company, there is one combustion chamber to each opposite pair of furnaces—that is, three combustion chambers, with waterways running fore and aft the boilers between them. In the *Australia* and *Galatea*, by Messrs. Napier, there is one combustion chamber only to the six furnaces. The results obtained by the single combustion chamber boiler are

superior to the others, as will be seen from the following table." Now what do we see in the following table? We find that the *Galatea* develops 9,653 I.H.P., with a pressure of 138 lbs. of steam, while the *Orlando* and the *Undaunted* respectively develop 9,120 and 9,092 I.H.P., or nearly 500 or 600 H.P. less, with a pressure of only 129 and 126 respectively. What I wish to say is this: that the safety valves of the *Galatea* were loaded to 10 lbs. more than those of the *Orlando* and the *Undaunted*.

Mr. Soper—As Mr. Price has called the attention of the meeting to an apparent discrepancy in my paper, I will deal with his remarks first. In the case of the *Australia*, where the load on the safety valves was the same as in the case of the *Orlando* and the *Undaunted*, the power was kept down. I think Mr. Kirk, who was present at the trial, was rather anxious not to do too much on that occasion, and he would not let the engines take all the steam that the boilers developed, and rather kept the steam down.

Mr. Kirk—The throttle valve was 2½ in. open.

Mr. Soper—I was not present at the trial of the *Australia*, but in the *Galatea* Mr. Price calls attention to the increased steam pressure in the boilers. Well, the pitch of the propellers in the *Orlando*, the *Undaunted*, the *Narcissus*, and the *Immortalité* was approximately 18 ft. 6 in., and to reduce the number of revolutions of the *Australia* and *Galatea*, after the trial of the *Australia*, the pitch of both propellers was increased. I think the *Galatea* on her final trial was increased to about 20 ft. 9 in. I do not know if Mr. Kirk can bear me out in that statement; I am only speaking from memory. I think it was increased by about 2 ft.

Mr. Kirk—The revolutions, at all events, were reduced to, I think, 115; I do not recollect the pitch exactly.

Mr. Soper—And the boilers were worked at a higher pressure. The safety-valve pressure in the case of the *Galatea*, in accordance with the rule which Mr. Sennett stated this afternoon to be well within the limit of the safety-valve pressure, was increased to 138 lbs. The engines were allowed to run freely, but I may say that the first half-hour, if I remember rightly, the H.P. developed was less than in any other half-hour; and, if Mr. Kirk had wished and had been willing, he could have developed a constant mean of about 9,650 I.H.P. right throughout; but the power increased from the first half-hour right up to the last half-hour. I was present at the trial of the *Galatea*, and also at the trials of the *Orlando*, the *Undaunted*, the *Narcissus*, and the *Immortalité*. In the case of the *Australia* and the *Galatea* we had no trouble whatever to keep steam; it was the easiest matter possible; but in all the other ships we did have some difficulty, and I attribute that in great measure to the single combustion chamber, and also, as I stated in my paper, to the use of the automatic feed pipes. My statements as to the satisfactory condition of boilers under the closed stokehold system have been fully borne out by both Mr. Marshall, when he referred to the Italian vessels, and Mr. Bevis, when he referred to the Holyhead boats. The only gentleman, I think, who expressed dissatisfaction was Mr. Howden. Now, by the kindness of Mr. Howden I was allowed last year to take passage in the *City of Venice* from Glasgow to Liverpool, so as to see his system at work. Of course I tried to find out as much as I could about it, and I managed to get hold of the weights of the boilers; and, comparing his system with the forced-draught trials of the *Anson*, I think the proportion of horse-power to ton weight of boilers was in the ratio of 20 with his system to about 45 with the *Anson*. Now, Mr. Howden objected to Mr. Fothergill's system that there was no forced draught about it. Well, supposing there is about his system, we are quite ready, I am sure, to steam any of our vessels across the Atlantic if we are allowed to develop 20 or even 30 H.P. per ton of boiler; and after they have been across the Atlantic we will send them round the world. But of course it is a different thing when you are working with 1½ or 2 in. of air pressure. That, as Mr. Kirk stated, was only to be used in a case of emergency; perhaps we might run many hours at that without any danger at all. We should never think of crossing the Atlantic in all weathers with a pressure of 1½ to 2 in.; but with a moderate air pressure, the same as we had on our 96 hours' trial, I am positive we should have no difficulty whatever. Mr. Scott mentioned the question of the comfort of the men in the stokeholds. I think when forced draught was mentioned in 1883 alarm was expressed that the men would object to being under the closed stokehold system, and that the discomfort would be so great that on this account only it would have to be abolished. Now, we find the reverse; that in the closed stokehold the men are as willing to go there as they are in the others; in fact, very often when we have got natural draught trials we have trouble to keep the doors open—the men shut them because it helps keep the steam. I have been told that with the closed ashpits, on any system, the air being drawn by the fans from the stokehold, the coal dust is constantly circulated about the place, and it is altogether uncomfortable, and the men dislike it very much; and, as Mr. Scott said about the firemen who work under Mr. Alfred Holt, they all look out for the forced-draught boats which are fitted with the closed stokeholds. Now, there was one remark of Mr. Kirk's in which he referred to the single combustion chamber. When I mentioned the increased durability I had in my mind what Mr. Kirk stated—that was, the effect of air being admitted direct into the furnace. Although I do not think there is much bother with a single combustion chamber, still, with a large combustion chamber of course it bears a much smaller proportion to the total volume, and it is less prejudicial. There is also the absence of the water spaces between the single combustion chambers. Those spaces are almost impossible to clean, and if the heating surfaces are not clean, with any system of forced draught, they are sure to bulge and give trouble; so that even to leave them out on that account is, I think, a great advantage. I think, gentlemen, I have said all I have to say. I must thank you for the kind way in which you have received my paper.

The Chairman—Gentlemen, I think it is now our duty to thank Mr. Fothergill and Mr. Soper for the two papers they have given us, and which have led to so instructive a discussion. (Cheers.)

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.

THE closing business meeting of the fourth session was held in the Lecture Hall of the Literary and Philosophical Society, Newcastle-on-Tyne, on Wednesday evening, May 9th, Mr. W. Theodore Doxford, president, in the chair.

A discussion took place upon Mr. Alex. Taylor's paper on the "Construction of Pontoon and Floating Dry Docks," after which the following general business of the Institution was taken up:—

It was agreed to increase the subscriptions of the junior members, and if the funds would permit to open central offices for the Institution in Newcastle-upon-Tyne, and to found a reference library for the use of the members. It was also suggested that as the number of members who reside in the Hartlepools and Tees Ports had considerably increased, the Institution should endeavour to hold some of its meetings in that vicinity.

The President intimated that the committee appointed to formulate a rule for the horse power of marine engines had, after two years' work, presented its report to the Council, and that the report should be printed in the present volume of the "Transactions," and copies of it should be also laid before the kindred institutions and societies of the kingdom. Arrangements were also being made for the Institution to pay a visit to the Forth Bridge Works, which visit would likely take place during the last week in July next.

The President then announced the result of the ballot to fill up the vacancies in the Council for the ensuing year, viz.:—President, F. C. Marshall; Vice-Presidents, H. Macoll and R. L. Weighton; Hon. Treasurer, B. G. Nichol; Councilmen, J. R. Fothergill, James Patterson, John Price, A. Scholefield, and R. S. White.

The new president having taken the chair, declared the session closed.

Electric Ships' Telegraphs.—The Engine-room Telegraph Committee, which have been sitting at Portsmouth for more than a year, have now prepared their report. As a consequence of their experiments and deliberations it has been determined to fit the whole of the ships of the *Admiral* class with electric, in addition to the usual mechanical, telegraphs for communicating between the bridge and the engine-room. As the ventilation of the dynamo flats in these ships is so bad that it is well-nigh impossible for the men to live in them for any length of time, it has also been resolved to provide them with peace fittings in the shape of additional dynamos. These will be placed on the main deck and will be of 100-ampère power. In time of war the service dynamos, which are below the water-line and are protected from shot, will be used for the search lights and glow lamps. Another innovation is to be introduced whereby four projectors will be fixed in each of the Nordenfelt projections at the corners of the superstructure deck, so that in case of an ejected torpedo attack the ships will be able to surround themselves within radial beams of light.

FOTHERGILL'S PATENT NON-ACCUMULATIVE STEAM REDUCING VALVE.

THE speciality which forms the subject of this notice is one which we believe will be found to be indispensable in the great majority of — if not in all — modern steamers. Even with the moderate steam pressures in vogue in the era of compound engines, reducing valves were necessary in connection with steam galleys, &c. Now a great demand has been created for reliable reducing valves, principally by the adoption of the high pressures of steam used in the triple and quadruple expansion engines, and were it attempted to dispense with these useful articles, it would be requisite to make all the deck machinery and auxiliary steam piping of much greater strength, so adding useless weight to, as well as increasing unnecessarily the outlay of capital on, the modern steam vessel.

As has already been indicated, a reducing valve is no new invention, but many of the so-called reducing valves of earlier design were well known to be unreliable, varying in correctness frequently as much as 20 lbs. and 25 lbs., and were especially unfitted for marine purposes; while practical experience at sea with Fothergill's valves has, we are glad to say, demonstrated that on a long voyage their greatest variation does not exceed 5 lbs.

Fig. 1 shows the momentary position of the two pistons

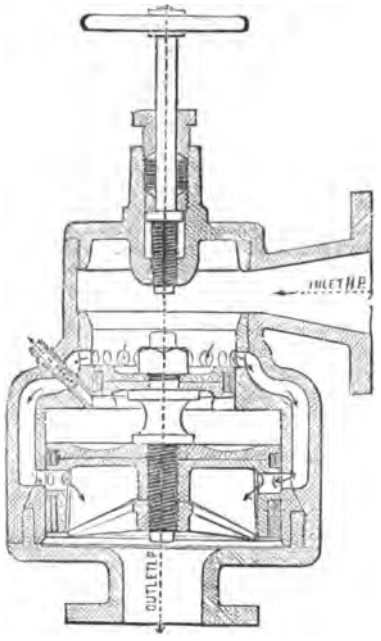


FIG. 1.

(which are connected together) when steam is first turned on. These pistons have areas of dissimilar extent, as the required difference of pressure may necessitate. As steam from the boiler enters the valve, if it be greater in pressure than required for the steering gear, winches, &c., the pistons assume the position shown on fig. 2. Here it will be observed the steam admission ports are closed, owing to the preponderating pressure on the underside of the low-pressure pistons. When the valve is at work, and steam is produced in the boilers, or used at the winches or steam steering gear in variable quantities, the pistons are in constant though slight movement, and take up an intermediate position. The valve is so arranged that should any steam leak past either piston, it immediately escapes by the pipe, shown on the left hand of our illustrations, to the atmosphere, thus absolutely obviating any accumulation of pressure, and rendering this reducing valve a perfectly safe and reliable one. It is also fairly claimed that the frequent motion of the

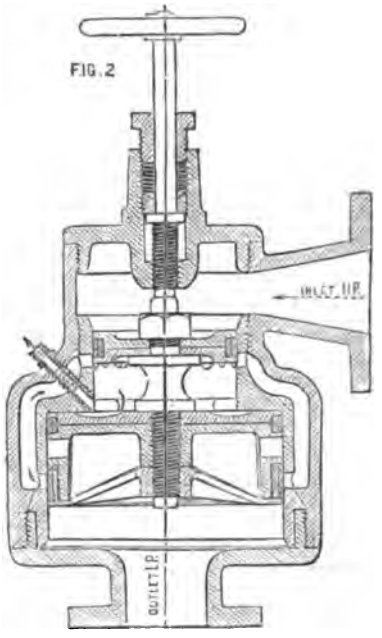


FIG. 2.

pistons tends to keep the cylinders in good working order, and to make the valve exceedingly sensitive, while if in any emergency it should be deemed necessary to use the full pressure of steam, this is obtained by screwing down the spindle, which secures the valves in their lower position.

We are glad to learn that many of the leading marine engineers are adopting Fothergill's reducing valve. In one steamer on which this valve has been fitted, the steam is reduced from 140 lbs. boiler pressure to 50 lbs. There are two reducing valves on board this steamer, one to the steam jackets and the other to the winches; and the chief engineer's report is identical with the captain's, particularly as to no accumulation of pressure. Equally satisfactory results have been given in several other steamers having higher boiler pressures up to 160 lbs.

Mr. J. R. Fothergill, the patentee of the Non-Accumulative Reducing Valve, is a well-known superintendent marine engineer in West Hartlepool, and was led to design and patent his Reducing Valve owing to the great need of a reliable one; thus, once again, "necessity" was the mother of "invention." We congratulate him upon his success, and at having obtained, as the sole manufacturers of his Reducing Valve, Messrs. H. Watson & Sons, High Bridge Works, Newcastle-on-Tyne.

MESSRS. WM. MURDOCH & Co.—We have received from this well-known firm of Glasgow engineers a notification of their change of address, which will now be 79, Robertson Street, Glasgow, and not Carlton Place, as heretofore.

WATSON'S PATENT ORIENTAL DOUBLE-ACTING STEAM AND OTHER PUMPS.

AMONGST the reliable auxiliary engines for pumping purposes on board sea-going vessels that are now in the market, not the least important are those manufactured by Messrs. Henry Watson & Sons, engineers, High Bridge Works, Newcastle-upon-Tyne. We have, therefore, pleasure in illustrating and describing their Patent Oriental Double-Acting Steam Pumps, which have been specially designed by them for the purpose of feeding the high-pressure boilers now so commonly in vogue in marine practice.

As will be seen at a glance from our illustrations, these steam pumps are very compact, while, at the same time, substantiality in their construction has not been overlooked. Fig. 1 is a side elevation and fig. 2 a front view

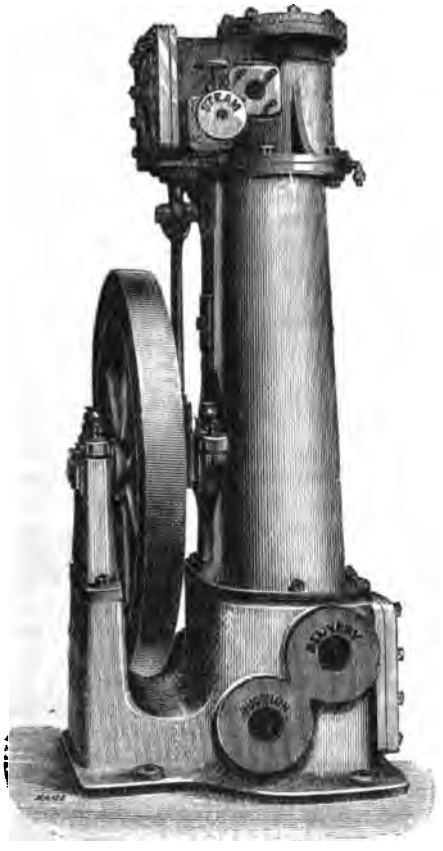


FIG. 1.

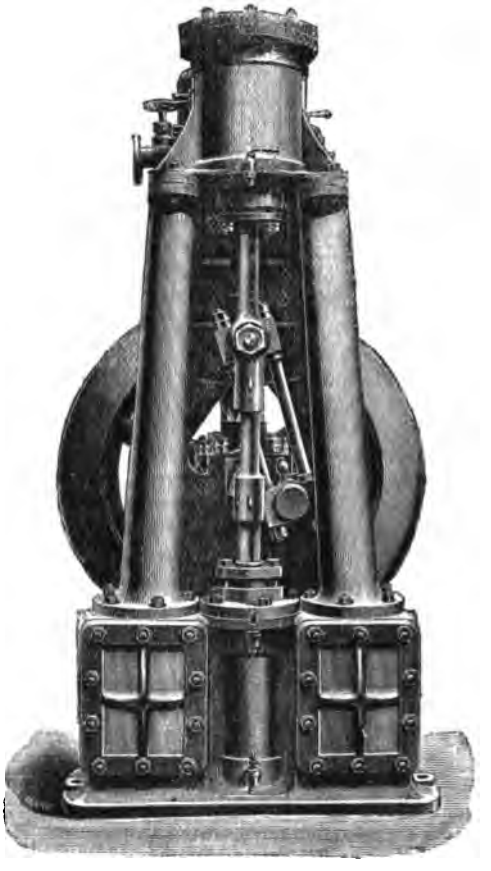


FIG. 2.

of the Patent Oriental Pump. We have seen two sizes of this pump, viz., one with a steam cylinder 8 in. diameter, and a pump-barrel 4 in. diameter, 8 in. length of stroke; the other having a 10 in. steam cylinder and 8 in. pump barrel, 10 in. length of stroke, the latter being also specially arranged for pumping out water ballast, being fitted with india-rubber valves. This pump is capable of discharging 65 tons of water per hour. The columns supporting the steam cylinder are utilized as air vessels, and are placed over the valve-boxes, which, it can be seen, are easily accessible for examination and repairs. The columns are connected to each other by a cast-iron web, having a bearing for carrying one end of the crank shaft, and a planed slot for guiding the motion-block. In order to facilitate the re-packing of the pump piston, a distance-piece is fitted between the piston and pump-rod, which, when removed, permits the pump pistons to be drawn out, examined, and replaced without taking adrift the piston-rod or its connections. The crank-shaft, on which the flywheel is mounted, is placed low down, and the method employed for actuating the crank-shaft reduces the side strains to a *minimum*. A special detail is that by which the gun-metal valve-seats are prevented from moving.

It is claimed, and we think those of our readers who, like ourselves, have seen them at work will be inclined to admit, that these steam pumps have practically a non-liability to break down, even if not carefully superintended and controlled.

Another patent steam pump of Messrs. Henry Watson and Sons is their Patent "Vertical Duplex" Pump, for feeding high-pressure boilers. One of these pumps has been at work night and day for a year feeding four Lancashire boilers. The "Vertical Duplex" Pump is very well designed and compact. The valve-box is of gun-metal, and the standards carrying the cylinders are

of cast steel. There is no fly-wheel, crank-shaft, nor eccentric, and the steam admission valve of one cylinder s worked by levers from the motion-block of the other, resulting in a slow, steady, and constant delivery.

As regards the workmanship displayed in the pumps already mentioned, no words of praise of ours are necessary, as the makers have justly a celebrated name for their manufactures.

Their attention has not, however, been merely confined to Donkey Engine Pumps; this firm is also equally at home in the manufacture of the Downton Deck Pump. They have also introduced an improvement upon the last-mentioned speciality, known as Watson's Improved Navy Pump. The latter is designed to give a greater efficiency than the ordinary Downton Pump for the same manual power, in which, we understand, it has been successful. It has only one lifting bucket, as against three lifting buckets in the "Downton," but so skillfully is it constructed that it has 85 per cent. efficiency of the more elaborate pump with which we contrast it, while, as can readily be understood, not more than half the labour has to be expended in working it.

HALL'S PATENT POWER "EJECTOR" VENTILATORS FOR STEAMSHIPS.

IT can scarcely be said that the ventilation of the spaces set apart for the accommodation of passengers, captain, engineers, officers, and other seafarers, has in many instances been perfected, not that it is impossible to accomplish this highly necessary requirement for the health and comfort of those interested, but because of the crude ideas that have frequently been resorted to, as well as to in many instances a false economy.

The ordinary cowl and mushroom ventilators have each their respective disadvantages, rendering them frequently useless, and yet they are still most commonly used. There is, even in this age of general advancement in naval architecture and marine engineering, too much of the conservative principle dominating the arrangement of what are, in one sense, minor but still highly important items in ship construction, and in no particular is this so plainly seen as in the very important matter of ventilation. No apology is therefore necessary on our part for calling our readers' attention to Hall's Patent Power "Ejector" Ventilators for ejecting foul air from steamships, &c. We believe it has been demonstrated in practice, as well as by experiments, that no fixed ventilator can properly do the work required unless there be some active power to draw off the foul air *continuously*, and accordingly Mr. Hall came to the conclusion that in order to obtain a perfect ventilator it was necessary to secure the continuity of its action by pressure, exerted by either wind, steam, water, or air. In our first illustration we show an external view of Hall's A class "Ejector" Ventilator, which is specially designed and made for deck cabins. In this instance wind pressure is entirely relied upon; but unlike the ordinary "cowl" ventilator, its action is *automatic*, as it will move round to any quarter so long as it is suitably placed—a very great advantage. They are usually made in sizes varying from 3 in. diameter to 12 in., but larger sizes are also procurable. Not only are these ventilators invaluable for deck cabins, but they would be a great boon on top of the engine and boiler casings in many steamers where excessively "hot air" is very frequently trapped; and we commend them to the attention of superintendent engineers, as well as to naval architects and ship surveyors and other interested parties. In our second and fourth illustrations two of these A class "Ejector" Ventilators will be seen at each side of the steamer's funnel, showing at a glance their manifest suitability.

For ventilating a large number of state-rooms, saloons, &c., which could not effectually, if at all, be ventilated, owing to structural and other necessities by independent ventilators of the type already described, the B class "Ejector" has been specially designed and patented. These work with a steam jet from the boilers, air pressure from a fan, water from a pump, or any other available pressure. One of them is shown at the centre of the funnel in fig. 4 and at the centre line of the portion of a steamer's amidship section in fig. 2, and on a larger scale in fig. 3. It works double, drawing air from the right and left hand, in each instance from four or more state-rooms, &c., as will be seen on an examination of the last-mentioned illustration. A steam pipe with stop-cock is also shown, through which the jet of steam for ejecting the foul air passes—if so desired—into the funnel, thus at the same time increasing the draught from the furnaces. As already explained, it is not, however, only by steam that the B class Hall's Patent "Ejector" Ventilator can be worked. Water pressure might also be advantageously employed, seeing the facility with which water at from sixty to seventy pounds per square inch, in the small quantity required, could be supplied by a pump worked by the main engines, and which would make the arrangement comparatively inexpensive. Thus by a moderate outlay for piping, water having sufficient pressure could be laid on to any required number of ventilators.

Hitherto passengers on steam-vessels have not been very exacting as to the efficiency of the ventilation of their state-rooms, but as they become aware of the practicability of having as "good" air in their confined sleeping apartments on board ship as on land, undoubtedly there will be a largely increased demand of such specialities as those we have now briefly alluded to.

Hall's Patent Power "Ejector" Ventilators are solely manufactured by Messrs. Fairbairn & Hall, engineers, 63, Royal Exchange, Manchester, who are also well-known as the patentees and manufacturers of water elevators, automatic injectors, jetometers, ejectors, and water-lifters for land and sea purposes, of which twenty thousand are working in all parts of the world. The general utility of the patent Ventilators which we have described will commend themselves to those passengers and others who have experienced the disagreeable, stifling and stale atmosphere of ill-ventilated state-rooms and saloons, and who have also had the good fortune to make a passage in vessels fitted up with Messrs. Fairbairn and Hall's Patent Power "Ejector" Ventilators. It is also a matter of no small importance for intending purchasers that each ventilator is thoroughly tested before leaving the makers' works, so that there is an absolute surety of obtaining a first-class and reliable article. It is not therefore surprising that already a large number of steamships have been fitted with these ventilators, and we can only trust they will become more extensively used as they are more widely known.

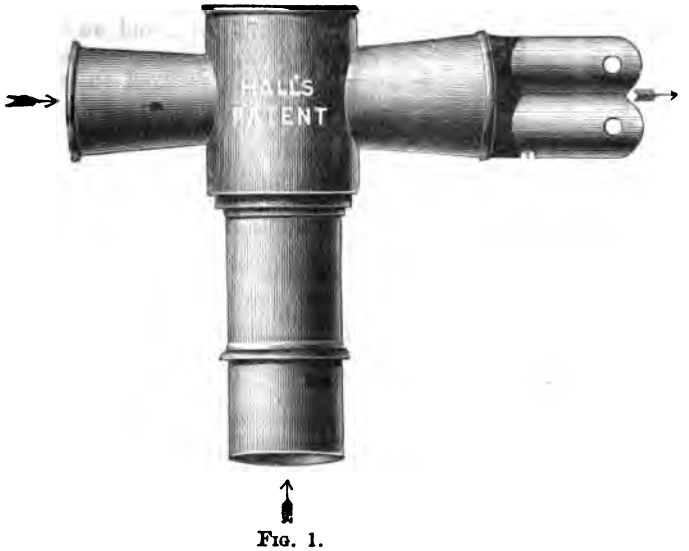


Fig. 1.

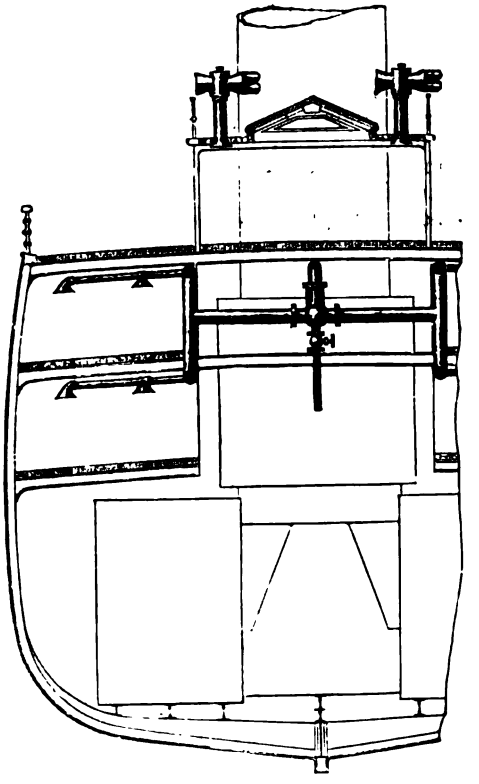


Fig. 2.

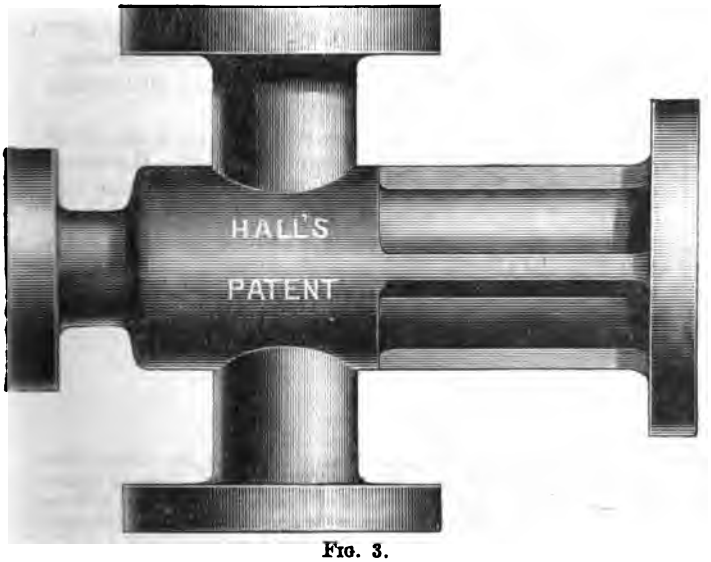


Fig. 3.

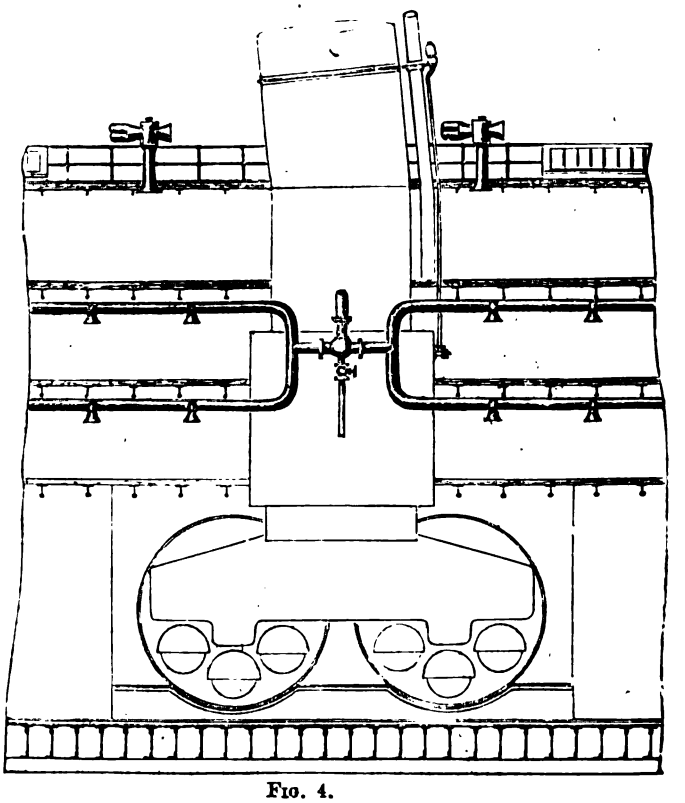
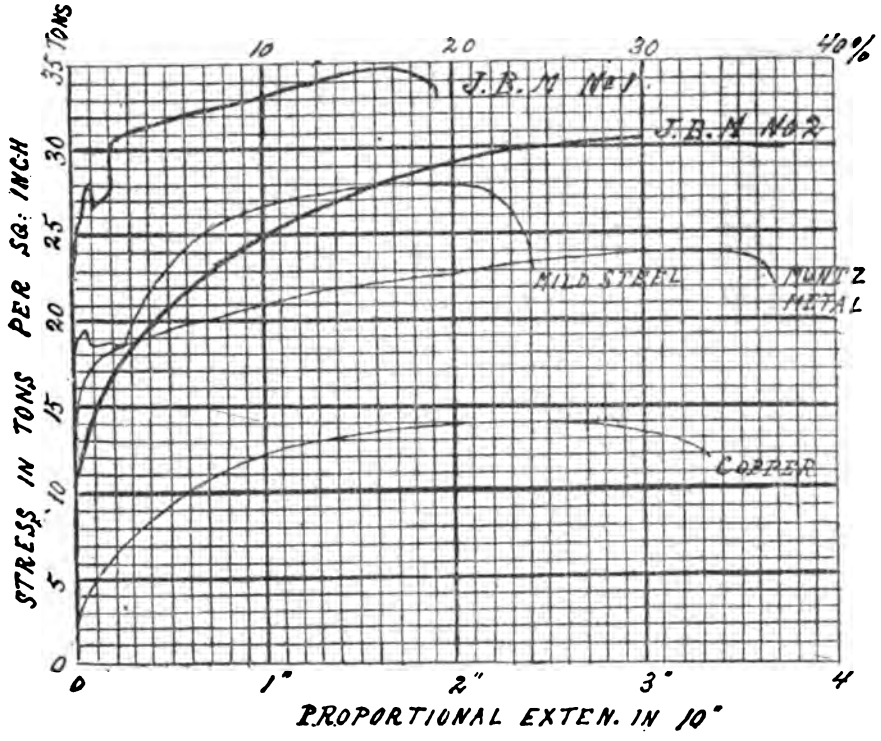


Fig. 4.

BULL'S PATENT METAL.

WE have recently had submitted to our inspection samples and test pieces of a new metallic alloy invented by Mr. John Bull, of 18, Adolphus Road, Finsbury Park. The new alloy can be rolled, forged, and otherwise wrought when at a dull red heat, with the same ease as wrought iron, and when so treated the alloy attains the same tensile and elastic limit as good Bessemer steel, a fact fully proved by the annexed diagram which has been prepared from tests made by Messrs. J. Buckton and Co., of Leeds. The alloy will cast like gun-metal and may be turned or otherwise finished in a manner which leaves nothing to be desired. For marine and hydraulic purposes its chief value will be found in its peculiar and eminently steel-like characteristics, which is strikingly illustrated in the diagram by the peculiar manner in which it yields when the elastic limit is passed; suddenly giving way about 2 per cent., and as suddenly recovering itself and, as it were, fighting bravely to the very last, a peculiarity which has hitherto only been observed in steel.

In the test marked "J.B.M. No. 1" on the diagram, a $\frac{3}{4}$ inch hot-rolled bar was turned by Messrs. Buckton to $\frac{5}{8}$ inch diameter, and broken in one of their automatically registering Wicksteed testing machines. The bar showed a tensile strength of 34·76 tons, and an elastic limit of 24 tons, with an elongation of 19·3 per cent. In this test the peculiar move before referred to is very marked. The specimen marked "J.B.M. No. 2" represents the test of a hot forged bar in a softer alloy. Here the metal shows a tensile resistance of 30·46 tons with an elongation of 30 per cent.



A comparison of these results with the tests of other metals shown on the diagram ought to convince the most sceptical that Mr. Bull has succeeded in producing an alloy which possesses many advantages to commend it to the notice of engineers generally, to whom we should also state that the alloy is of a perfectly accurate and uniform composition without alternating hard and soft parts or hard steel particles.

Under the title of The Gaseous and Liquid Fuel Supply Company, Limited, a company has just been registered to take over the patents of Mr. B. H. Thwaite, C.E., F.C.S., of Liverpool, for generating water gas, and other descriptions of gaseous fuel, for gas motors, gas furnaces, and for heating purposes generally, and for the application of Mr. Thwaite's patents for heating and lighting with liquid hydrocarbons. The Company will establish a fuel-testing laboratory and act as guarantors against smoke-nuisance fines. It will be seen that the objects of the Company in effecting fuel economy and preventing smoke are likely to be a public advantage.

Locomotives and Canals.—Last month, on the Shropshire Union Canal at Worleston, the London and North Western Railway officials tested the experiment of drawing canal boats with a locomotive. A set of rails 18 in. wide and about a mile in length had been laid along the canal bank. On them was placed a small locomotive from Crewe Railway Works. When steam was up two boats were attached by ropes to the locomotive, which drew them along easily at the rate of seven miles an hour. Four boats were then attached, and the same speed was attained, the engine working very smoothly. The experiment was deemed successful.

WILSON'S PATENT INSTANTANEOUS BOAT RELIEVING CHOCK.

THERE is probably no operation carried out on board ship where the desirable qualifications of certainty and speed become more essential than in the getting clear of a boat.

Many inventors have recognised this fact, and as a consequence we have had several very ingenious boat lowering and boat relieving devices brought into the service, but few, if any, of these have struck, as Mr. J. P. Wilson has done, at the root of the matter; that is to say, first get your boat clear of the chocks.

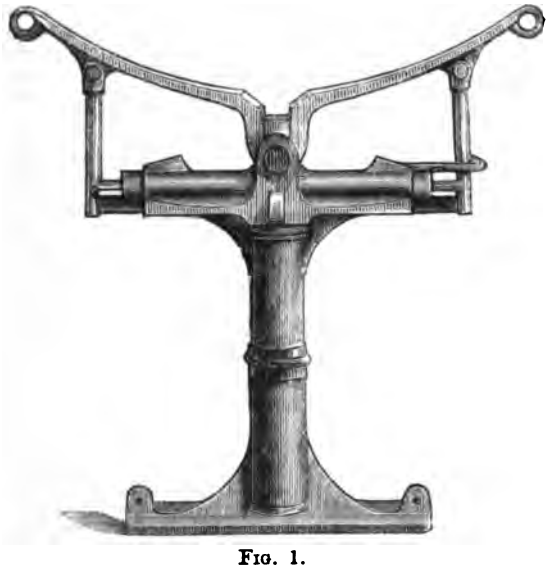


FIG. 1.

As will be seen from the accompanying illustrations, of which fig. 1 shows the chocks up ready for seating the boat, and fig. 2 the chocks down and all clear for the boat going out-board, the improved method of releasing the boat is an extremely simple one and may

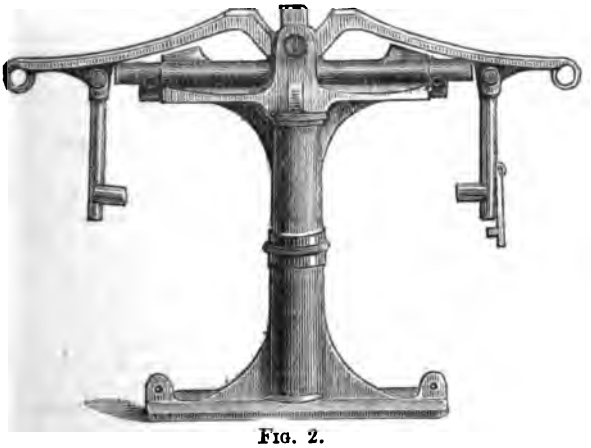


FIG. 2.

under all circumstances be effected with certainty and speed. Mounted on cast-iron pedestals, similar to those now in use, are the chocks suitably formed to receive the configuration of the boat. These, as will be seen, are pivoted at their inner ends, and each is provided with a pendant bar which by means of the small projection shown, takes into the recessed head, fastened one on each end, of the horizontal bar passing through the pedestals, where, when in place, it is locked by a simple hook. Assuming now the boat to be in place and the chocks *in situ*, as shown in fig. 1, it is only necessary to unlock the upright bars and impart a half-turn to the horizontal bar to at once ensure the chocks falling and the boat being left all clear, and as the chocks fall below the line of the boat's keel there is no need to raise the boat to clear them.

The arrangement is neat, simple, and strong, and the cost, we are told, is less than the present clumsy arrangement of wooden chocks, which generally become so fixed with paint, etc., that they are split before they can be released.

The inventor is a member of the firm of Messrs. Neish & Wilson, of 23, Exchange Square, Glasgow.

TESTS OF SPINDLE AND MACHINERY OILS.

WE have recently received from Messrs. Boult Bros. & Co. a couple of very interesting reports on the lubricating value of various oils. These reports embody the results obtained by the North of England Testing Laboratory, Liverpool, after carrying out a series of tests for Messrs. Boult Bros., and clearly demonstrate the great value of their well-known "Valvoline" as a lubricant. From the first of these reports we notice that with equal pressure, or load, on the journal (75 lbs. per sq. in. of longitudinal section of journal), the rise of temperature with "Valvoline" was only 34° F. in 205 minutes, while with "Neatsfoot" it was 47° in 102 minutes, with "Rape" 45° in 125 minutes, and with "Russian" 48° in 93 minutes; the rubbing surface in each case travelling 167 ft. per minute. This gives, in the order named, an average co-efficient of friction, for "Valvoline," ·0176, the others being respectively, ·0252, ·0236, and ·0257; or, in other words, the proportionate values of "Valvoline" 193·82, "Rape" 88·92, "Neatsfoot" 68·02, and "Russian" 60·34. Hence it will be seen that "Valvoline" does 62 per cent. more work with 25 per cent. less friction, and the generation of 25 per cent. less heat than the best of the other three lubricants.

The second report shows the value of "Valvoline Spindle Oil" as compared with four other lubricants. From the figures given in this report we find that, as regards friction, "Valvoline" and "Sperm" are equal (though it should be borne in mind the former only costs one-third of the price of the latter), that "Valvoline" is 25 per cent. better than "Shale," 36 per cent. better than "Neatsfoot," and 105 per cent. better than "Russian;" while at the same time producing a lower maximum temperature than any of the other oils.

Any comment on the above figures would be mere superfluity on our part; but we think it is only fair to Messrs. Boult to call our readers' attention to the fact that the results given in the second report were obtained on perfectly clean rubbing surfaces, and we have no doubt had the experiments been prolonged sufficiently to allow of the gummy and tarry deposits yielded by some of the oils named coming into play, the comparative results shown would have been even still more in favour of "Valvoline," which, as is well known, leaves no deposit whatever.

A NEW TORPEDO RANGE.—A torpedo range at Horsea Island, Portsmouth, costing £100,000, has just been completed and taken over by the Vernon Torpedo School. The range—some half mile in length—has been constructed for experimental purposes in connection with the discharge and flight of torpedoes, and with its canal, lock, quays, wharves, tramways, firing pier, offices, &c., forms a prominent feature in the view of Portsmouth Harbour as seen from the surrounding heights. Messrs. S. Pearson & Son, of Westminster, were the contractors for these works.

THE GLASGOW INTERNATIONAL EXHIBITION OF INDUSTRY, SCIENCE, AND ART.

I.—THE EXHIBITION GENERALLY.

THIS immense undertaking which has been occupying the attention of many of Glasgow's prominent citizens and business men for the past twelve months or thereabouts, was opened to the public on the 8th May by the Prince and Princess of Wales. The opening day throughout was exceptionally fine as regards weather, and Glasgow has seldom, if ever, presented so animated and gay an appearance. The streets were literally ablaze with gay bunting, festoons, and emblems, and the side walks along the whole route taken by the royal procession, to and from the Exhibition, were densely packed with people. The same is true of windows, balconies, improvised "grand stands," and every point of natural vantage ground. The reception of the royal personages was most enthusiastic and impressive all along the line going and coming, while in the Exhibition building and grounds the demonstration of loyalty was deafening and prolonged. After hearing the Inaugural Ode—written by Robert Buchanan, and wedded to music by Dr. A. C. Mackenzie—performed by the Glasgow Choral Union (400 voices) and declaring the Exhibition open, the Prince and Princess traversed most of the principal avenues and courts, evincing here and there considerable interest in the exhibits. The royal personages, with all accompanying, afterwards left the Exhibition, and took train to Hamilton, near which they resided during their short sojourn in the North.

Before describing the Exhibition Buildings, their contents and surroundings, it may be of interest to briefly narrate the events associated with its inception. As early as 1885 a suggestion was made to hold an exhibition in Glasgow; but in the meantime a similar proposal had been adopted by the citizens of the Scotch metropolis, and after due consideration the people of the western city decided not only to postpone their project, but, in a commendable spirit they threw in their lot with Edinburgh, the Glasgow Town Council and many of the citizens subscribing to the Guarantee Fund considerable sums of money, while from the West many valuable and important exhibits were sent. After the success of the Edinburgh display had been established, the proposal to have a Glasgow Exhibition was revived, and the Lord Provost of the city convened a public meeting for 6th October, 1886, at which the leading citizens of Glasgow and many members of the nobility and gentry of Scotland were present, either in person or by proxy. As the result of this and subsequent meetings it was resolved to hold an Exhibition of Industry, Science, and Art in the Kelvingrove Park, Glasgow, in the summer of 1888. Substantial evidence of the enthusiasm of those who took up the project officially and of the public generally was soon given by the rapidity with which the guarantee fund was raised, and to a total not anticipated by the most sanguine—£300,000. This figure is practically double the fund raised in the case of the Manchester Exhibition, and five times that of Edinburgh. While such steps were being taken to ensure the financial success of the undertaking the Executive Council were equally diligent in other respects. It was, after some discussion, determined that the Exhibition should be international in character, and Her Majesty gave it the royal stamp by conferring on it her patronage, as also did the Prince and Princess of Wales, the Prince and Princess Christian, the Duke and Duchess of Edinburgh, the Duchess of Albany, and the Duke of Cambridge. The objects aimed at and laid down in the prospectus were "to promote and foster Industry, Science, and Art, by exciting the inventive genius of our people to a still further development in Arts and Manufactures, and to stimulate commercial enterprise by inviting all nations to exhibit their products both in the raw and finished states." Examples of the manufactures by which Glasgow and the surrounding districts have become famous—chemicals, iron and other mineral products, engineering, shipbuilding, electrical and scientific appliances, and textile fabrics, it was decided, should form the chief feature, being exhibited both in process of manufacture and in the finished state. Influences were set to work to insure that similar and even more varied exhibits would be sent from all parts of the United Kingdom, from the Continent, and from India and other British dependencies. The co-operation of representative bodies in the principal cities and counties in the British Isles was secured, whilst in France, Germany, Austria, Italy, and Norway the work of organization bore good fruit. But probably the most interesting of the exhibits from other countries are those which were ultimately secured from India. In each of the Presidencies under Government supervision committees were appointed, charged with the collection of the principal articles produced within these regions. Those in Calcutta were gathered together under the experienced care of Mr. Mûkerji, who had charge of the Indian Department at South Kensington two years ago. The Government of Canada were secured as contributors of a collection, and also the Planters' Association of Ceylon. Everything, indeed, was done to secure that in the most comprehensive sense International Art, Science, and Industry would be represented. The result is that the Glasgow Exhibition is one of the most representative that has yet been held.

The actual work in connection with the building commenced with the acceptance of the design at a meeting held 31st March, 1887. It had been wisely decided to have a competition in connection with the designs, prizes of 150, 100, and 50 guineas respectively being offered for the 1st, 2nd, and 3rd. Three plans were recommended by the building committee, and ultimately the first prize was awarded to the design by Messrs. Campbell Douglas, and Sellars, and Mr. James Barr, C.E.; the second to Messrs. John Burnett, Son, and Campbell, with whom was associated Mr. Charles C. Lindsay, C.E.; and the third to Messrs. Peter Smith and H. E. Clifford, Architects, all of Glasgow.

The building, erected from the accepted design, occupies the entire area put at the disposal of the competitors, extending to about 10 acres. No time was lost in having the work commenced, and on the 2nd of May, barely five weeks from the acceptance of the design, operations were commenced in Kelvingrove Park. On that day Lord Provost King cut the first sod from ground immediately to the south of the Museum. The foundations for the building were completed in July, and by rapid strides the pile soon assumed shape and form, and the exhibition became a reality. The building was completed by the contractors, Messrs. Shaw and Son, Glasgow, in ample time to admit of the placing of exhibits and other arrangements preparatory to the opening—a somewhat unusual circumstance in connection with International Exhibition buildings.

Although at the inception of the movement the Executive Council had, as already indicated, to use all the influence they could command to secure exhibitors, this has proved to be unnecessary, except perhaps to ensure that the collection would be international in the widest sense of the term. Applications came from all countries, and in surprisingly large numbers. Indeed, more than twice the space available was applied for, and as a result, the Committees were able to exercise a certain selective power. The buildings and grounds altogether occupy an area of 66 acres. Manchester, it may be stated, included 45 acres, Newcastle 32, Edinburgh 28, London (1886) 22, and Liverpool (1886) 35. The buildings alone cover 474,500 square feet, being an increase of 20 per cent. upon the original design, the executive having been compelled to add this to partly meet the superabundant demand for space. The floor area of the buildings is apportioned as follows:—

268,000	square	feet	to general exhibits.
16,000	,,	,,	to the grand hall.
27,500	,,	,,	to picture galleries.
23,000	,,	,,	to dining rooms.
140,000	,,	,,	to machinery annexe, boiler sheds, &c.

The Glasgow International Exhibition is, in fact, in all its features, on a great scale. It is the custom to measure such undertakings in a rough way by acres, and by count of acres the Glasgow Exhibition is the biggest thing since 1862. But it has, at least, one other claim to that position. The buildings are finer than anything Britain has had within recent years. The nature of the site called for a building with a presentable outside, and to say that the Exhibition is able to make good its position in the middle of the West End Park, and in close proximity to the magnificent University pile, means, to those who know the situation, that the architect has been extremely happy in his design.

Saracenic in style, the principal structure—which stands on a broad plateau on the southern bank of the Kelvin, and immediately fronting the magnificent University of Glasgow which crowns Gilmorehill on the opposite side of the river—is in the form of a parallelogram, over 1,300 ft. long by 265 ft. wide, and comprises a nave and transepts, with a lofty dome, 170 ft. to the top of the vane, at the intersection, and a variety of towers and minarets of

oriental form at various parts. At the western end is a machinery annexe, with sheds for dynamos, boilers, &c., equal, as has already been said, to about 140,000 square feet. Two of the façades are in the line of public streets, but the principal, and, of course, the most ornate, faces Kelvingrove Park and the University. Here the ceremonial entrance is situated, and here in the design are lavished those exceedingly beautiful forms of ornament peculiar to the eastern style of architecture. Beneath an immense Arabian arch of horseshoe shape, a fretted triple doorway gives access to the vestibule. From this point the façade sweeps out on each side as a semi-circular verandah until it meets the central avenue, which is carried through the main building and machinery annexe, upwards of a quarter of a mile in length. This avenue is flanked by thirty-seven courts, while there are ten art galleries, numerous dining, retiring, and other rooms. In the grand hall—a nave with aisles, seated for 3,000 persons—there is at one end a fine organ and orchestral platform, and at the other the original model of Sir John Steell's statue of Burns, while the walls are covered with monochromes and photographs. On the north are the courts devoted to the Women's Industries section, in which there are contributions from all parts of the world, and in which female workers of several nationalities give demonstrations of their skill. To the south are the art galleries, which form a permanent structure, and which contain the most extensive collection of sculpture ever brought together in Scotland, and pictures to the value of half a million sterling. In the eastern portion of the main avenue and the courts to the north, textiles, skins, leathers, gutta percha, india-rubber, &c., are gathered, one small court being devoted to printing and stationery, and another to educational appliances. The space on the south is traversed by a corridor lined with road carriages, cycles, &c., and on the one side of this division there is a display of chemicals and scientific instruments, and on the other a collection of exhibits illustrative of mining, metallurgy, and house construction. In the centre of the building is the cupola of the dome, gorgeously decorated with arabesques and panels containing representations of "Art," "Science," "Industry," and "Agriculture," and the arms of Great Britain, France, Germany, and America; also of Canada, South Africa, India, and Australia. Immediately underneath the dome is a rockery with fountains, surrounded by a promenade. The transverse avenue which runs south, and which has the original model of Sir John Steell's figure of Sir Walter Scott, is occupied by jewellery exhibits.

In the western end of the main avenue amongst other exhibits there are congregated ships' models, deck-houses of steamers, and the like, which, as they represent a subject in which our readers are directly concerned, we treat of more fully later on, but to which, as well as to machinery exhibits generally, we will return in future numbers. The whole ends in a blue and gold trophy of Doulton ware. On the north are, first, the furniture courts, and then the Indian section, where a number of native artisans are seen at work. The south side is devoted to foreign and colonial contributions and to artisans' exhibits, as well as to a display representative of agriculture, food, drinks, &c.

The machinery section has the most varied collection of pieces of mechanism ever brought together in the north country. The space devoted to machinery is very much greater than the corresponding space in the Edinburgh Exhibition. At Manchester, the machinery in motion occupied more space than in Glasgow; but as the class of exhibits in the Glasgow display occupy less space per exhibit than many of those at Manchester, *e.g.*, cotton spinning and other textile machinery, which required large floor area, the collection at Glasgow is not materially less in number and certainly not less representative of the engineering industries.

Proceeding along the main avenue, past the large majolica trophy erected by Messrs. Doulton, towards the department where iron, steel, and the other industrial metals are shown in all their various forms and methods of application, the visitor finds at the entrance to the machinery section a large and important exhibit demonstrating the perfection to which the industry of artistic iron-founding has been brought in the west of Scotland. The exhibit is that of the well-known firm of Macfarlane & Co., Saracen Foundry, Glasgow. The Steel Company of Scotland occupy the stand next to Messrs. Macfarlane. Doubtless imagining that the fame which they have achieved in their own particular line is sufficient guarantee of the quality of their work, they have not attempted to show samples of their steel after being subjected to tests, which other makers of the metal consider necessary. The company have sent some heavy and finely finished castings, which form an imposing trophy, and they have displayed sections of angles and small work. The next stand in the avenue is that of Messrs. David Colville & Sons, Dalzell Steel and Iron Works, Motherwell. To show the excellent quality of their manufactures, they send a very large number of test bars and plates, which have been bent, hammered, and punched into a variety of forms while the metal was cold. In no instance are there the slightest evidences of fracture at the folds. Plates of considerable thickness which have been subjected to such severe treatment as being folded, and then again doubled close across the first fold, appear quite as sound as plates which have not been bent at all. Inch bars of steel are also shown which have been tied, while cold, into sailor's knots, without disturbing the external appearance of the fibre. Tests of a severe character have also been applied to many of the exhibits shown alongside by Hadfield's Steel Foundry Company, Sheffield. They produce a quality of metal which, in the form of railway wheels, is so tough as to be unbreakable, and to show only a wear on the tread of seven-eighths of an inch after running over 122,000 miles. Cast in the form of projectiles, it is shown practically uninjured after piercing wrought-iron plates of considerable thickness.

Beyond Colville's stand and that of the Hadfields Steel Foundry Company, which is a most interesting and comprehensive collection, there are several very important exhibits from a marine engineering point of view, which we can only name at present, but which we purpose returning to in another issue. Messrs. Charles Cammell and Co., of Sheffield, show a collection of iron ore, limestone, and pig-iron; "Wilson's" patent compound steel-faced armour plates; armour bolts in section; steel projectiles and forged shells; assortment of ordnance forgings for guns, from 6 in. B.L.R. up to 13·5 in. B.L.R.; sections of rails and fish-plates; forged steel crank shafts for marine and locomotive engines; cast steel propeller blades; steel tyres and axles, steel castings; bearing, volute, conical, and spiral springs; buffers; files, tool steel and pen steel. In close proximity to Messrs. Cammell's stand is that of the Phosphor Bronze Company, of London, who make a varied and striking display of their special and highly-approved alloys now so largely used in marine engineering. Adjacent to this is a very beautiful exhibit of a 3-throw crank shaft of the "built" type, patented and made by Mr. Dickinson of Palmer's Hill Works, Sunderland. To the left of this the Delta Metal Company make an attractive display of the various marine and other engineering items, in the manufacture of which their well-known specialty is used. Messrs. Hawthorn, Leslie & Co., of Newcastle, are strikingly represented at this part of the Exhibition by a beautiful working model of one of the two sets of the triple-expansion engines for the Royal Italian twin-screw, armour-clad *Sardegna*, now being constructed by the Societa Hawthorn, Guppy, Naples. These engines are designed to indicate in the aggregate 25,000 H.P., certainly the greatest power hitherto put into one vessel. The model works under steam at intervals and attracts large attention, being really a "thing of beauty," great skill having been brought to bear upon its construction. We hope in a future issue to illustrate the engines of which this model is a splendid counterfeit. Further on, Messrs. John Brown & Co., of Sheffield, make an effective display of "Purves'" patent ribbed boiler flues, Ellis' patent compound armour, marine shafting, and flanged boiler ends; also a monster boiler shell plate, 28 ft. long, 9 ft. wide, by 1⅛ in. thick. In the vicinity of this stand is that of Messrs. John Spencer & Co., of Newburn Steel Works, Newcastle, who display samples of their steel castings, forgings, &c., and adjacent are exhibits of same class by the Irwell Forge Company (Joseph Webb & Co.). Here also is the stand of T. Nordenfeldt, on which a most multifarious display of his "mitis" castings is made. Beyond this and at the extreme end of the avenue is the stand of Messrs. George Smith & Co., Sun Foundry, Glasgow. Consisting chiefly of artistic castings and reproductions of sculpture work in iron, the exhibit is very effective. There are two fountains of graceful design, and castings of Cupids, birds, and animals, which for fine contour and sharpness of modelling are almost equal to similar castings in bronze.

Scattered throughout other sections of the Exhibition are exhibits naturally pertaining to iron and steel manufacture. Of these we may mention specimens of fuel and materials used in the manufacture of iron and steel plates, shown by the Consett Iron Company in Court 3; exhibits and test-pieces shown by the North British Iron Works, Coatbridge; specimen ores and pig-iron by the Coltness Iron Company; the West Cumberland Iron and Steel Company, Workington; Messrs. William Baird & Co., Gartsherrie; the Coats Iron and Steel Company, Coatbridge; the Ebbw Vale Steel, Iron, and Coal Company, &c. Numerous companies doing a large business in the mining of coal and other

minerals are also embraced in this section of the Exhibition, extending through Courts 2 to 6.

The general nature of this first article on the Exhibition precludes us from going into the machinery or any other section with any systematic detail—a task which we reserve for future issues. It will therefore be sufficient, meanwhile, if we indicate briefly by name, irrespective of position, those stands in the machinery department which are most striking or of greatest interest to our readers. Firstly, however, it may be said that although marine engineering is most extensively represented, there is an absence of those very striking and heavy exhibits of actual marine engineering which one might have looked for in an exhibition organised in the very heart of the chief centre of the marine engineering industry. With the exception of a medium-sized engine, shown by Messrs. Ross & Duncan, of Govan, fitted with Bremme's valve gear, there are no engines of any great size apart from the stationary engines employed to drive the shafting for all the other items of machinery in motion. Interesting stands, in which are displayed steering gears, winches, pumps, &c., are plentifully scattered throughout the machinery section. Near the centre is the stand of Messrs. Alley & McLellan, of Sentinel Works, Glasgow, whose exhibits are attractive and interesting. The "sentinel" steering gear, which is their principal exhibit, is a comparatively new gear, and considering the short time it has been before the shipbuilding world it has met with a great degree of favour. We hope to illustrate and describe it more fully in next issue along with other matters on this stand. Not far from Messrs. Alley & McLellan's stand another exhibit of great importance to shipbuilders and boiler makers is shown by Mr. F. J. Rowan in the shape of patent electro-magnetic machines for drilling, riveting, tapping, &c., which have already met with acceptance wherever they have been practically tried, and for which doubtless there is a great future. The Leeds Forge Company and the Fairley Iron Company are both represented by large stands, the conspicuous feature on which are the corrugated boiler flues identified with each of these companies, besides flanged boiler plates, &c. Messrs. Lindsay, Burnett & Co., Moore Park Boiler Works, Govan, also show specimens of hydraulic and machine flanged boiler work in mild steel, and special marine boiler furnaces. William Beardmore & Co., Parkhead, Glasgow, show specimens of marine crank and propellor shafting, hollow and solid boiler ends, &c.

Messrs. Marshall & Sons, Glasgow, show good specimens of lap-welded iron and steel boiler tubes, as do also Messrs. A. & J. Stewart. The stand of Mr. John Cochrane, Barrhead, contains one of Atkinson's "cycle" gas engines of 2 H.P., which drives a comparatively new dynamo-emery grinding wheel by Messrs. L. Sterne & Co., Glasgow, who make an excellent show of their specialities. Another and more conspicuous exhibit by Mr. Cochrane is a horizontal high-pressure steam engine of 100 H.P., driving lines of shafting in this section, the belting employed being an entirely new kind, invented by Messrs. Tullis, of leather fame.

Near Ross and Duncan's engine Wigham, Richardson & Co., of Neptune Works, Newcastle, show a fine model of triple-expansion engines as fitted on the s.s. *Alphonso XII.*, belonging to the Compania Trasatlantica, Spain. Fielding & Platt, of Gloucester, made an extensive display of their pumping and other engines, together with photos and drawings of an improved system of hydraulic cargo and other gear for ships, a branch of hydraulic work into which they have lately entered with considerable success.

Clarke, Chapman, Parsons & Co., of Gateshead-on-Tyne, show examples of their well-known steam windlass winches, capstan pumps, and steering gear. Amos & Smith, of Hull, also show their approved steering gear, as do Messrs. Napier Brothers, of 100, Hyde Park Street, Glasgow, along with their windlass, capstan, and other specialties.

The Worthington Pumping Engine Company, of Victoria Street, and the Pulsometer Engineering Company, Limited, of Queen Victoria Street, London, have each an interesting collection of their specialities, as have also Messrs. Lancaster & Tongue, of Manchester. Messrs. G. & J. Weir, Glasgow, show their highly-approved patent feed water heater and several examples of pumps for supplying steam boilers with non-corrosive feed-water. Drysdale & Co., of Bon Accord Engine Works, Glasgow, show their improved "Bon Accord" centrifugal pumping engine for circulating and other purposes. The exhibits of these and many other firms, whom we cannot now even name, will be more fully discussed in subsequent issues.

Wood working and metal working machine tools also find place in the machinery section, and in the gallery surrounding the vast collection, and from which a magnificent view of the machinery can be had, there are innumerable stands containing the lighter items of engine and ships' outfit, such as governors' cocks, belting and packing of all kinds, but we defer noticing these till another issue.

The important department of naval architecture forms the feature of the western portion of the Grand Avenue. The Fairfield Company show a fair selection of the models of the numerous and varied fleet of vessels they have built. Amongst these are several Atlantic racers, the *Queen Victoria* and the *Empress*, the Isle of Man Company's famous boats, the Czar's yacht *Livadia*, and last, though not the least interesting, the model of a vessel about to be commenced for the Guion line, which, it is hoped, will beat the record by crossing the Atlantic in five days. Messrs. D. & W. Henderson show models of the *Belgravia*, *Oopack*, and other vessels; and Messrs. Barclay & Curle models of a number of the steamers and sailing ships built by the firm. Messrs. J. & G. Thomson have eight models on view, all of them superbly finished, including those of the cruisers *El Destructor* and *Reina Regenta*, of H.M.S. *Scout*, as well as of the *City of New York*, at present in course of completion for the Inman Company. A state-room for the sister ship, *City of Paris*, not yet launched, is also exhibited. Messrs. Denny Bros.' principal exhibit is a main-deck dining-saloon, which, internally, constitutes one of the finest objects in the exhibition. It has been specially prepared for the exhibition, chiefly with the view of showing the skill of the firm's own employés in structural and decorative work. It is a double house (music-room above and dining-saloon below), with well for giving light and air. The chief feature of the dining-room is a sideboard in walnut-wood, elaborately carved, with the crest of the British India Steam Navigation Company in the centre-panel, and in the frieze allegorical representations of shipbuilding and engineering. Among other exhibits by this firm are models of the *Jumna*, *Apollo*, and *Minora*, and a working model of the quadruple-expansion type of engine, invented by Mr. Brock, of Messrs. Denny & Co., engineers. Messrs. Alex. Stephen & Sons, Linthouse, have on view 37 half models and three full models—one model for each year the firm have been engaged in shipbuilding on the Clyde. During that long period they have launched from their yard no fewer than 309 vessels, and every one of them, it may be mentioned, has been modelled by the respected senior partner of the firm, Mr. Alex. Stephen. Among the exhibits are included the *Sea King*, better known as the Confederate cruiser *Shenandoah*. The London and Glasgow Engineering Company show models of the *Glengyle* and *Glenshiel*, built for Messrs. M'Gregor, Gow & Co., of the steel screw steamers *Locksley Hall*, *Branksome Hall*, and *Rufford Hall*; and of the *Princess of Wales*, built for the Great Eastern Railway Company, and others. The exhibits sent by Messrs. Robert Napier & Sons illustrate in a striking way the development of naval architecture and marine engineering. They include models of H.M.S. *Krebus*, the first floating battery, built during the time of the Crimean War, and examples of most of the intermediate types of warship down to the recently launched cruisers. Then there are models of the *Vanguard*, the first paddle steamer built by the firm, and of the paddle steamer *Scotia*, in her day a famous Cunard Liner. There are also models of the *Atrato* and *Damascus*, and of the telegraph cable steamers *Amber*, *Mirror*, and *Electra*.

Alongside the models are shown photographs of the triple-expansion engines fitted up in the *Australia*, *Aberdeen*, and *Damascus*, and of the twin-screw and triple-expansion engines for the Russian ironclad *Sinope*, at present being fitted up at Sebastopol. Messrs. A. & J. Inglis show two beautiful models. Messrs. Wm. Simons & Co., Renfrew, have 28 half and seven full models, some of them possessed of considerable interest, as representing vessels in which new features were introduced. One model which will attract the attention of a large class of visitors is that of the *Rothesay Castle*, at first a crack Clyde river boat, then a blockade runner, and now making the passage between Toronto and Niagara. Messrs. Lobnitz & Company, Renfrew, have also an important exhibit. Messrs. Fleming & Ferguson, Paisley, show a selection of models and photographs illustrating some of the types of vessels and machinery which are their specialities. In other adjoining courts are models of several Allan Liners, and examples of the skill of Messrs. A. M'Millan & Son, Dumbarton; Swan, and Hunter, Newcastle; D. J. Dunlop & Robert Duncan & Co., Port Glasgow; Napier, Shanks, & Bell, Yoker; Joseph L. Thompson & Sons, Sunderland; J. B. Seath, of Rutherglen; W. S. Cumming, Blackhill Dock, Parkhead, Glasgow; Cochran & Co., Birkenhead, &c. All these and other exhibits, however, will form the subject of a more detailed article in a future number.

One of the great attractions of the exhibition is the grounds,

which are of a singularly beautiful character. The grand entrance to the main building commands a clear view of the grounds and the various erections thereon. Of these the Bishop's Palace and the Fairy Fountain are certain to attract the lion's share of attention. The fountain, which is situate in the line of the main approach to the grand entrance, has been designed and entirely constructed by Messrs. Galloway & Sons, of Manchester, and embodies several features suggested by their experience with like fountains at the Colonial Exhibition of 1886, and at Manchester last year. The house containing the pumping engines and dynamos for the electric lighting is situated on the opposite side of the Kelvin, the water-pipes and electric wires being carried across the river on a temporary wooden bridge. The pumps are capable of delivering 200,000 gallons of water per hour, and are provided with a double set of three-throw rams. They are coupled direct to one of Messrs. Galloway's horizontal compound engines, with high and low pressure cylinders 14 in. and 24 in. in diameter respectively, with a stroke of 3 ft. Two Siemens' B 13 dynamos supply the electric current for the lights under the fountain jets. They are driven by an engine of similar size to the pumping engine, but fitted with a different valve gear and running at a higher velocity. The steam for driving these engines is taken from the battery of boilers situated to the south-west of the machinery annexe. The distance is about 700 ft., and the pipes are carried in an underground culvert large enough to permit of access for examination and repairs.

On the southern bank of the Kelvin stands the City Industrial Museum, where the Queen's Jubilee presents are deposited; Van Houten's Dutch house, the Indian and school of cookery tea-rooms, a large number of conservatories, a band-stand, a terra-cotta fountain which Messrs. Doulton & Co., London, have presented to the city, and an iron one which Messrs. M'Dowall, Steven & Co. have erected. Down the bank, steps lead to landing-stages to be used by those who patronise the gondolas, electric launches, and torpedo boats which ply on the river. Over the Kelvin three new bridges have been thrown—a large one close to the Prince of Wales' Bridge, and a pair further down. The two great bridges converge on the northern bank, and at their junction there is a couple of kiosks for the sale of tobacco and sweets, flanking a broad path to the "fairy fountain."

In the buildings and grounds there will be the largest installation of the electric light which has taken place in connection with any exhibition. The interior of the building is almost entirely illuminated by arc lamps of the Brush pattern. The art galleries are lighted by about forty Thomson-Houston arc lights, and the refreshment rooms by Messrs. King, Brown, & Company's incandescent lamps. In the grounds the Brush lamps are generally used, fifteen masts over 60 feet high being erected on both sides of the Kelvin for the outside illumination. This feature, however, it has not yet been found necessary to bring into force until the evenings darken somewhat. The detached buildings scattered throughout the grounds are fitted with several different systems of lighting. One of the courts in the lighting section, and the large dining-rooms in the gardens, have been fitted by Messrs. James Milne & Son, Glasgow, with Wenham gas lamps. The large tea-room near the grand stand and the Indian tea-room are to be lighted by the Defries Safety Oil Lamp Company, of London and Glasgow. A band-stand on the south bank of the Kelvin, the engine and dynamo house in connection with the fairy fountain, and a court in the lighting section, will be lighted by Siemens' gas lamps. A third court in the lighting section, a large band-stand on the north of the Kelvin, and the popular dining-rooms will be lighted by Bower gas lamps. The two kiosks, situated one on each side of the main approach to the grand entrance, and the fairy fountain, are to be illuminated by the Scottish Incandescent Gas Light Company. There will thus, in addition to the very complete installation of Messrs. W. & J. Galloway & Sons in connection with the fairy fountain, be three different systems of electric lighting, four systems of gas lights, and one example of oil lamp illumination simultaneously on view in the exhibition and grounds. When the evenings grow darker this arrangement will afford a favourable opportunity of comparing the three great methods of artificial illumination—electricity, gas, and oil.

SHIPBUILDING ON THE THAMES.—Messrs. Green, of Blackwall, launched, May 9th, a steel paddle steamer, 210 ft. by 22 ft., for Messrs. Cousens, of Weymouth. The guaranteed speed is 15 knots, and the machinery, of 850 H.P., is being constructed by Messrs. John Penn & Sons. In conjunction with the same engineers, Messrs. Green are now building the two new powerful Woolwich ferry steamers for the Metropolitan Board of Works.

NEW VESSELS OF WAR.

THE keel-plates of two new vessels of war, to be named the *Barrosa* and the *Beagle*, were laid down in Nos. 4 and 5 docks at Portsmouth on Monday morning, May 14th, and as a considerable amount of the material had been prepared in advance in the workshops, some of the frames and bulkheads were placed in position during the day. The *Barrosa* belongs to the four protected cruisers of the *Blanche* class now in course of construction. They are intended for service on distant stations, where docking accommodation either does not exist or may not be available in time of war, and with this object their steel hulls will be sheathed with wood and coppered. The dimensions of the *Barrosa* are:—Length, 220 ft.; breadth, 35 ft.; and the mean load draught, 14 ft. The weight of hull is 853 tons, and the displacement at the load line, 1,580 tons. The protection steel deck will extend throughout the entire length, and have a *maximum* thickness of two inches over vitals, and a *minimum* thickness of an inch. The twin screws will be worked by engines of the vertical triple-expansion type, and will be required to develop 2,000 horses with natural draught and 3,000 under forced draught. The boilers will be of the ordinary return-tube marine type. On the measured mile it is expected that a speed of 16½ knots will be realized, and 15 knots at sea with continuous steaming. The ship will carry 160 tons of coal, which will give her a radius of action of about 3,500 knots at a 10-knot speed. Her armament will consist of six 36-pounder quick-firing guns, four 3-pounders, and two torpedo tubes. Light fore and aft steadying sails will be carried. The *Beagle* is also specially intended for remote foreign stations, and consequently will be sheathed and coppered to avoid the necessity for repeated docking. She is a sloop of the *Buzzard* type, of which there are four built and building, but will differ from the first of the class in being constructed of steel instead of being composite built. She will be 195 ft. in length, 30 ft. in breadth, and will have a mean draught of 12 ft. 5 in. In hull she will weigh 605 tons, while her load displacement will be 1,170 tons. Her engines are to indicate 2,000 under forced draught. The *Beagle* will carry eight 5-in. breechloaders and the same number of machine guns into action.

LAUNCH OF THE UNITED STATES CRUISERS, "YORKTOWN" AND "VESUVIUS."

THE Government cruiser *Yorktown*, launched on May 28th, from Cramp's yard, in the Kensington district, is an unarmoured steel vessel of 1,700 tons displacement, with twin-screw engines, and is designed to make a speed of 17 knots. Her armament consists of six 6-in. steel breechloaders, firing 100-lb. shells.

There was simultaneously launched from the same yard a "dynamite cruiser" of 725 tons displacement, with twin-screws, and engines designed for 3,200 H.P., and making 20 knots. Her mean draught is nine feet. Her armament includes three guns, built side by side into the ship, from which will be projected, by means of compressed air, shells containing each 200 lbs. of dynamite. These missiles will, it is expected, surpass in destructive effect anything yet attempted in the shape of movable torpedoes. The guns project above the deck at an angle, and their fire is a plunging one, the vessel being moved in order to aim the guns. Two other cruisers, each of twice the *Yorktown's* displacement, are now being built in the same yard.

A vast number of people witnessed the proceedings, crowding the wharves and piers for miles, while hundreds of steamers dotted the river, with other craft of all kinds. The Secretary of the Navy brought a large portion of Congress by special train from Washington to witness the ceremony. Miss Cameron, daughter of Senator Cameron, christened the *Yorktown*, and Miss Breckenridge, daughter of Representative Breckenridge, christened the dynamite gunboat, naming her *Vesuvius*. The event attracts much attention, being regarded as the beginning of a regenerated American navy, for the building of which Congress is expected to vote liberal supplies.

ACCIDENT TO A STEAMER—The recently-launched Inman steamer, *City of New York*, when entering the basin at Thomson's shipbuilding yard, Clydebank, Tuesday morning, May 15th, struck the 100-ton steam sheers, causing them to fall on her deck. Damage to the vessel is restricted to loss of bowsprit and figurehead.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from April 24th to May 24th 1888:—

Baker, Alexander, engineer to the *Undaunted*, to date April 25th.
Christian, Thos. W., additional assistant engineer to the *Orlando*, to date May 24th.
Cocks, Fred. A., chief engineer to the *Indus*, additional.
Colquhoun, Peter, fleet engineer to the *Excellent*, additional, to date May 18th.
Ellis, Matthew W., engineer to the *Indus*, additional, to date April 25th.
Fincham, W. C., chief engineer to the *Surprise*, to date April 25th.
Frowd, W. S., additional assistant engineer to the *Orlando*, to date May 24th.
Gulliver, Wm. H., staff engineer to the *Orlando*, to date May 24th.
Hibbard, John A., additional assistant engineer to the *Orlando*, to date May 24th.
Hincheliff, Wm. F., additional assistant engineer to the *Orlando*, to date May 24th.
Jones, Richd. W., engineer to the *Nile*, to date April 25th.
Leighton, James, staff engineer to the *Magicienne*, to date May 23rd.
Monkhouse, Warwick, assistant engineer to the *Hero*, additional, to date May 18th.
Moon, Wm. H., engineer to the *Hecate*, to date April 25th.
Preston, Theodore J., staff engineer to the *Pembroke*, to date April 30th.
Rashbrook, Henry S., engineer to the *Pheasant*, to date April 25th.
Robbins, John J., engineer to the *Hero*, additional, to date May 18th.
Sanders, John Stocker, chief engineer to the *Indus*, additional, re-appointed temporarily on promotion, to date April 7th.
Taylor, Wm. M., fleet engineer to the *Glatton*, additional, to date May 18th.
Watson, Alfred D., engineer to the *Espiègle*.
Westaway, Albert E. L., engineer to the *Orlando*, to date May 24th.
Wootton, Wm. W., chief engineer to the *Excellent*, additional, re-appointed on promotion, to date April 6th.

HOAR & BROWN'S HARDWOOD MARKET REPORT, 23rd May, 1888.

TEAK.—The deliveries up to the 23rd of the month shew a considerable falling off as compared with the four preceding months. This may be accounted for by the intervention of the holidays, and also the approach of the close of the quarter, when most of the large rolling-stock and shipbuilding companies are narrowing down their stocks to the smallest possible margin in view of the anticipated half-yearly balancing.

The stocks are as follows:—

	1888.		1887.	
	Logs.	Planks.	Logs.	Planks.
Moulmein	5570 lds. ..	495 lds.	7755 lds. ..	499 lds.
Rangoon	1120 ,, ..	147 ,, ...	1268 ,, ..	268 ,,
Bangkok	838 ,, ..	104 ,, ...	2760 ,, ..	687 ,,
Totals	7528 lds. ..	746 lds.	11763 lds. ..	1454 lds.

These constantly decreasing figures show a sounder market than we have had to report for some considerable time, and when we consider that a large portion of the floating supplies have been sold to the Continent and outports there is no doubt that the present strong position of the market will be maintained.

The active demand that has prevailed for some time past on the other side of the Channel still continues, and although we have no new shipbuilding or railway carriage contracts to report, both industries are fairly busy, and are likely to continue so for some considerable time. The stocks, though greatly reduced, are quite ample for present requirements.

The attempt on the part of the shippers to force up the f.o.b. prices has not met with any success, and from the advices we have received we do not anticipate any large consignments during the coming season, while prices on this side are lower than those being quoted at the port of shipment.

PLANKS.—There appears to be a considerable quantity of planks coming forward, but unless the shipments are of better specification than those recently arrived we do not see that prices for parcels can be maintained.

GREENHEART.—The stock of this wood has been very much decreased of late. Although we are not able to report any advance in prices, there are several large enquiries afloat which may have the effect of giving a considerable rise to the present quotations; the deliveries to the 18th of the month have amounted to 190 loads, leaving about 724 loads now in the docks.

MAHOGANY.—The activity which we reported last month has been continued this. Although the quantity of wood recently put upon the market has been large, it has not been more than the requirements of the trade necessitated, the Honduras wood realising very full prices.

The firm attitude of the importers has given buyers great confidence, and there is no doubt the prospect of this branch of the hardwood business is most encouraging.

The quantity now in the docks amounts to 6789 logs, of which 2270 logs were landed this month; the deliveries up to the 18th amount to 1625 logs.

CEDAR.—We are not able to report any improvement in this wood, although the present slightly reduced stocks are being held firmer. The large quantity suitable for box-making, &c., should induce manufacturers to avail themselves of the present time rather than wait for a phantom fall in price.

AMERICAN WALNUT.—The business done in this wood has been rather small during the last few weeks, but the stock of good wood is still very low, and fair prices have been obtained. The business in cut stuff is a very largely increasing one, and the low figure at which it sells finds it a ready market, although the quality of a large proportion of it is not all that could be desired.

WHITEWOOD.—Prices for logs are lower than have been known for some time past, and where sales have been forced importers have had to take prices that must have left them a very large margin of loss. The supplies have almost wholly ceased, so there is no doubt prices will very quickly return to a healthy level.

SEQUOIA (Californian Redwood).—The splendid dimensions of this wood ought to make it very valuable, and as it comes forward absolutely free from all faults we feel sure that the more it goes into consumption the greater will be the appreciation.

OAK.—There is little or no stock of either American or Dantzic, so that there is no doubt the new shipments of both classes of wood will meet with a very ready market on arrival.

THE IRISH EXHIBITION IN LONDON.

THE forthcoming Irish Exhibition in London, to be opened on June 4th and to continue till October 27th, will be held at "Olympia," Kensington, and will, we trust, meet with a hearty and cordial measure of support from all parts of the United Kingdom. From the list of patrons we are pleased to see that the exhibition is receiving the support of nearly all the leading men of the day, and we think that the names on the Executive Council are sufficient guarantee that nothing will be left undone to ensure, in every way, the success of what must prove to all an interesting exhibition.

Probably those of our readers who visit the exhibition—(and by the way the facilities for doing so are great, as 331 trains and 126 omnibuses run to Kensington daily)—will be most interested in Department C, which, under the broad heading of "Shipbuilding and Sea Industries," comprises eight cognate sections, viz.: Ships; Construction; Fitting; Engines; Life-Saving; Armament; Sea Industries; and Inland Fisheries.

The holding of such an exhibition will give to all an opportunity of studying the resources and industries of the sister Isle, an opportunity which all interested in Ireland (and who is not?) ought to avail themselves of.

The profits we are pleased to see are to be given in aid of Irish technical and commercial schools.

While wishing every success to the Irish Exhibition, as an exhibition, we cannot conclude without expressing the hope that it may result in much solid good and practical service to Irish industries.

THE GREENWICH HOSPITAL PENSION.—The Greenwich Hospital Pension of £50 a year for fleet, staff, and chief engineers, vacant by the death of Mr. Wm. H. Grose, has been awarded to Fleet Engineer William Gill.

AUXILIARY MACHINERY OF WARSHIPS.

A MODERN warship is often referred to as a huge box of machinery; it may therefore prove interesting to our readers to give a list of the auxiliary engines in the charge of the chief engineer of such a ship as the *Trafalgar*. In the Navy, the term "auxiliary engine" includes all engines except the main propelling engines, which, in the ship we have mentioned, would be of the twin screw triple-expansion type. In this ship there are two engine-rooms and four boiler-rooms, all entirely separate and independent of each other.

In each boiler-room there is one *main* feed pump of the Admiralty two-cylinder type, and also one *auxiliary* feed pump of the same size and description as the main. Thus, there are eight feed pumps.

In each engine-room two Admiralty pumps are fitted, called the *bilge* pumps, to be used for pumping out bilges, or for washing decks, or as auxiliary fire-engines, or to pump out the boilers.

In each engine-room one large Admiralty pump is fitted as a fire engine to pump either from the sea or bilge.

In each engine-room two circulating centrifugal pumps are fitted to draw either from the sea or bilge through the surface condenser or direct overboard. These are generally driven by single cylinder engines, and are usually arranged so that each pair can be coupled up. In addition to these four centrifugal pumps, there is also another smaller pump for circulating the water through the auxiliary surface condenser, which is used in harbour for condensing the steam from the electric light and other engines.

Each vessel is provided with a duplicate set of distilling apparatus, attached to each of which is a small engine working three pumps, one for supplying the condensers with salt water, another for pumping the condensed steam back again to the boiler, and the third for pumping the distilled water from the receiving tank of the apparatus into the ship's tanks.

In each engine-room all the drains from the cylinders, jackets, &c., empty themselves into a small tank fitted well down in the bilge of the ship; and a small Admiralty pump is specially fitted for pumping from these drain tanks into the feed tanks.

As the whole of the mechanism for working the heavy guns is driven by hydraulic pressure, pumps fitted with either air or steam accumulators are required for generating this pressure. There are always two such pumps supplied.

In several ships special pumps are provided for washing out the guns after each round.

In addition to the bilge, fire, and circulating engines being utilised for pumping out the ship in the event of a leak, powerful ejectors, or sometimes pulsometer pumps, are fitted—one in each of the main compartments—to clear the vessel of water. There is besides, a powerful hand pump in the engine-room, which can also be used for pumping the boilers up or out, or on deck in case of fire; and some eight large Downton pumps can also be used in case of fire or leak.

The water pumps of the ship number therefore about forty, and the engines working them about fifty—the engine consisting of one cylinder and one piston.

As mechanical torpedoes enter largely into the armament of a modern warship, a complete system of air compressors, reservoirs, &c., is required for charging the torpedoes with air at a pressure from 1,000 to 1,500 lbs. on the square inch. There are two sets, at least, of compressing pumps fitted, each of which consists of two distinct engines and pumps. Reckoning that the vessel carried twelve torpedoes—which is placing her on a very low scale—as each torpedo contains a propelling engine of some 60 H.P., and making from 800 to 1,000 revolutions per minute, it is evident that some little attention is required in this quarter to keep these deadly weapons in a ready state of efficiency. As a rule, the torpedo engines are the well-known three-cylinder single acting type.

In each boiler-room there are two fan engines fitted for supplying the furnaces with air when the boilers are being worked under forced draught. In addition to these eight fans, there are about four others fitted in various parts of the ship for ventilating purposes.

For the powerful search lights that are required for sweeping the horizon at night and for the internal lighting of the ship, three separate engines and dynamos are provided. The engines are usually of the closed three-cylinder single acting type.

In each boiler-room a double cylinder ash hoist engine is fitted for getting the ashes and clinker away from the stokehold.

Each large ironclad has a workshop containing a couple of lathes, planer, drill, punch, and other machine tools, all of which are driven by a two-cylinder engine called the workshop engine.

The main engines would not be readily manipulated if the starting and reversing had to be done by hand; to get over the difficulty, a two-cylinder engine with a differential valve is fitted to each set of engines.

For turning the main engines when the ship is at anchor, so as to facilitate repairs or examinations, a small engine is provided which will revolve the main engines about once in ten minutes.

Steam has entirely superseded manual labour both in the steering of the ship, and in working the capstan, for each of which purpose a powerful double cylinder engine is fitted.

For lifting inboard the torpedo and other large boats a warship carries, two powerful winch engines are placed on the upper deck.

For rotating the massive turrets or platforms holding the heavy guns, rather large engines are required. There is one set of two-cylinder engines to each turret or barbette.

As the charge of powder for a Woolwich infant weighs close upon 300 lbs., and the weight of a shell for the same gun is not far short of a ton, special ammunition hoist engines are provided to each turret or barbette.

The rammers and sponges for these guns are also worked by small engines, and the mechanism for elevating or depressing the gun, and for running it in or out, really consists of small engines all of which are directly under the charge of the chief engineer.

The governors for preventing the racing of the engines in rough weather are now really small steam engines in themselves.

There are sometimes small engines fitted for other purposes, such as flushing latrines, or pumping dirty water from the bath rooms overboard, or for raising and lowering the funnels; but those already enumerated bring the number of separate engines in the chief engineer's charge to about 90: or reckoning separate cylinders as engines to somewhere about 150. Besides these the chief engineer is entirely responsible for all the watertight doors, sluice valves, and flooding valves being kept in an efficient state ready for working at a moment's notice: and once a quarter he has to examine and keep in order all the double bottoms and inner plating of the ship; so that virtually he is responsible for the hull, machinery, torpedoes, guns and mountings, and in fact everything except the navigation of the ship and the discharge of the guns and torpedoes.

A large ship carries two second class torpedo boats whose engines indicate about 200 I.H.P. each, and which are fitted with numerous small engines and mechanism; and also one or two smaller steamboats all of which are in the charge of the chief engineer.

Seeing that so much depends on this officer for the well being of our men-of-war both in times of peace and war, it seems incredible that he should be only a civilian officer, while the officer who works out the ship's course, and does no other duty than attend to the navigation of the ship, or those officers who keep watch on deck and have passed in the obsolete science of seamanship, are executive officers. As all engineer officers during their training have to learn sword and rifle drill and go through a course of gunnery and torpedo instruction, and are therefore fully qualified in every sense to be combatant officers, yet under existing regulations the youngest midshipman in the Navy is entitled to take precedence over the most senior officer in the engineer branch in the event of there being no higher executive officer present.

MERCHANT STEAMSHIPS OF THE WORLD.

ONE of the most noteworthy facts in connection with mercantile marine enterprise is the enormous addition which has been made to merchant steamships during the last six or seven years. An excellent list, with appreciable particulars respecting their build, engines, and tonnage, is given of the ships belonging to all countries in the last edition of "Lloyd's Universal Register." We propose to give an account of the number of those ships that are given in that work of 100 tons register and upwards. This information will be followed by a few other facts, relevant to the subject of this article, that are likely to be interesting to our readers.

The total number of steamers in the world in 1886 was 9,969, having a gross tonnage of 10,531,843 tons, as against 25,155 sailing vessels with a nett tonnage of 10,411,807.

The following table gives the entire number of steamships owned by all countries in 1886, viz.:—

	Number of Steamers.	Gross Tonnage.
Great Britain	5,057	6,169,065
Colonies	735	426,806
Total	5,792	6,595,871
France	509	742,662
Germany	579	654,814
United States of America... ...	400	503,677
Spain	401	356,912
Italy...	173	230,342
Netherlands	152	175,476
Russia	212	153,329
Sweden	437	158,788
Denmark	200	140,009
Norway	287	142,185
Austria	123	145,611
Belgium	68	105,508
Japan	105	77,936
Greece	82	59,839
Brazil	141	62,060
Chili	43	41,530
China	27	37,319
Turkey	82	54,697
Portugal	27	23,336
Mexico	15	17,664
Argentine	43	17,089
Hawai	21	10,969
Peru...	5	6,081
Roumania	4	2,674
Hayti	5	2,386
Uruguay	19	7,422
Savanak	4	1,210
Bolivia	1	1,032
Siam...	4	1,027
Persia	1	838
Costa Rica	2	528
Venezuela	4	909
Zanzibar	1	213

The number and tonnage of the steamships built by the nations of the world are as follows, viz:—

	Number of Steamers.	Tonnage.
United Kingdom	224	274,234
British Colonies	16	3,657
Germany	23	36,310
United States of America... ...	16	18,795
France	6	8,345
Austria	3	4,784
Sweden	12	4,596
Norway	3	1,647
Netherlands...	5	1,198
Other Countries	5	3,375
	313	346,941

In 1886 Germany built nearly three times the tonnage built in the previous year. On the other hand, while the tonnage of steamships built in the United Kingdom in 1886 exceeded that of 1885, it was not proportionate to the aggregate increase of the steamship building of the world during the previous-mentioned year. In 1885 78·9 per cent. of the steamships constructed in the world were built in the United Kingdom, but this proportion was more than 2 per cent. lower in 1886.

The undermentioned table gives an account of the principal materials of which the steamers of all countries in 1886 are built, viz:—

Material.	No. of Steamships.	Tonnage.
Iron	8,198	8,911,406
Steel	770	1,206,962
Composite	109	32,820
Wood	892	380,655
Total ...	9,969	10,531,843

As many of the fastest merchant steamships will probably be engaged to assist men-of-war in great maritime hostilities, it will be interesting to know how many of such ships can be propelled at 16 knots an hour or upwards if chasing or in chase in the capacity of armed cruisers. There are very few, and appear to include only the following steamers built and building, and having the speed specified as regards them, viz.:—British: the *Etruria* and *Umbria* of the Cunard Line, 19 knots; the *Ormuz* of the Orient Line, 18 knots; the *Alaska* of the Guion Line, the *Aurania* of the Cunard Line, the *City of Rome* of the Anchor Line, the *Austral* of the Orient Line, the *Victoria*, *Britannia*, *Arcadia*, and *Oceana* of the P. & O. Line, 17 knots; the *Arizona* of the Guion Line, the *Orient* of the Orient Line, and the *Servia* of the Cunard Line, 16½ knots; and the *Rome*, *Carthage*, *Valetta*, and *Massilia* of the P. & O. Line, 16 knots. Two immense twin-screw steamers of about 9,000 gross tonnage are being built for the White Star Line which are intended to have a speed of about 20 knots, and two twin-screw steamers of about 8,500 gross tonnage are being constructed for the Inman and International Line, which can be propelled at about 19 knots. Of the high-speed French steamers suitable for war cruisers there are *La Bourgogne*, *La Champagne*, *La Bretagne*, and *La Gascogne*, belonging to the General Transatlantic Company, each being capable of being driven at 18½ knots an hour. The *Portugal*, and two nearly ready for sea, christened *Brésil* and *La Plata*, belonging to the Messageries Maritimes Company, can be propelled at 17 knots, while another steamer, not yet named, to be put on their Australian Line, will be able to steam at 17½ knots speed for a few hours. As to the fast steamers belonging to the German Mercantile Marine, all of them except one belong to the North German Lloyd's Line. One of them at least, the *Lahn*, can be driven at 19 knots as a cruiser, while the *Trave*, *Aller*, *Saale*, *Werra*, *Fulda*, *Ems*, and *Eider*, can be propelled at 18½ and the *Elbe* at 17½ knots. The Hamburg-American Steamship Company are also having a steamer built for them which is estimated to be driven at a speed to equal some of the faster North German Lloyd's ships. It is thought that the *Persea*, *Regina*, *Margherita*, and *Orioni*, belonging to the General Italian Navigation Company, can also be driven at 16 knots as improvised cruisers for the few hours before referred to.

The General Transatlantic Company propose to build within two years a splendid twin-screw steamer of very large tonnage and enormous power. It is estimated that as an improvised war cruiser she can be driven at 19¾ knots an hour for six hours consecutively. She will have the best improvements, and may be classed in importance as a naval auxiliary with those building for the White Star and Inman Companies. As a Transatlantic steamer she will be by far the best foreign ship afloat. Some very fast voyages were made across the Atlantic last year. The best was made by the *Etruria*, which ran in August last from Queenstown to Sandy Hook in 6 days 3 hours and 18 minutes. The next fastest run was performed by the *Umbria*, which covered this passage in 6 days 4 hours and 34 minutes. The third place of honour in speed is to be awarded to *La Gascoyne*, of the General Transatlantic Company, which averaged 17·80 knots between Havre and New York, having eclipsed the run of the fastest North German Lloyd's steamer for the year by nearly one-third of a knot.

THE RIVER TYNE.—The annual financial statement of the River Tyne Improvement Commissioners has been laid before a meeting of that body in Newcastle-on-Tyne. The gross receipts on revenue account during the year 1887 amounted to £231,227, being £31,329 less than in the previous year. The falling off in the gross revenue is mainly due to the unfortunate strike of miners in Northumberland, and the consequent total stoppage of nearly all the collieries from Jan. 27 to the end of May. The loss of contracts in consequence of the strike caused a diminution in shipments up to the end of November; but in December there was a decided recovery, the shipments for that month being considerably in excess of those for the corresponding month of 1886. Now that work has been fully resumed, and marked signs of improvement in shipbuilding and other branches of trade are visible, the Commissioners anticipate that the business of the port will exhibit steady growth. Notwithstanding the temporary decline in the coal shipments owing to the causes named, the receipts from imports and exports of general merchandise show a satisfactory increase. Evidence of the revival of trade is to be seen in the great reduction in the tonnage of idle vessels "laid up" in the port, which in 1886 reached 137,000 tons, and at the close of last year amounted to 140,000 tons, inclusive of vessels which are not likely to go to sea again. The imports into the Tyne during 1887 have been 1,384,731 tons, against 1,312,007 tons in 1886. The exports, exclusive of coal and coke, were 756,145 tons, against 710,499 tons, and those of coal and coke were 8,537,330 tons, against 9,670,328, making a total tonnage export in 1887 of 10,678,206, against 11,692,834 in 1886.

INDUSTRIAL NOTES.

CLYDE AND EAST OF SCOTLAND.

THE measurement of the vessels ordered during the past month is not by any means commensurate with that of the vessels launched. A number of contracts are in the market, and, in some cases, are likely to be placed. The principal of these is for the six 5,000-ton vessels for the Argentine trade, mentioned in last month's notes, though it was reported at the beginning of the month and generally credited that the contract had gone to the Barrow Shipbuilding Company. It is also stated that inquiries in this connection are in the market for 25,000 tons of steel. Another contract likely to be settled soon is for a steamer for French owners.

The most important contract secured during the month is that by Messrs. Scott & Co., Greenock, who have contracted with the Admiralty to build and engine two first-class gunboats of 850 tons each. The engines are to be of 1,200 H.P. each, and both hulls and engines are to be completed at Greenock. The vessels will be named the *Sparrow* and the *Thrush*.

The other yards in the Greenock district are fully occupied. Messrs. Russell & Co. have secured a contract to construct for Glasgow owners a barque of 1,300 tons, the keel of which is to be laid down on the blocks vacated by the steamer *Spindrift*, lately launched. Messrs. D. J. Dunlop & Co., Inch Works, Port Glasgow, have contracted to construct a large caisson for the docks in Nova Scotia, which will be similar to that in use at the James Watt Dock, Greenock.

The trustees of Messrs. Blackwood & Gordon, who suspended payment about a year ago, have arranged with Messrs. Murdoch and Murray, shipbuilders, Port Glasgow, for the completion of the large steamer of 3,700 tons, in frame at the time of suspension. This steamer was originally intended for Messrs. McBetti & Gray, Glasgow, but the trustees for a certain sum settled their claims. The yard, which for so long employed a large number of men will, therefore be again re-opened.

Altogether the yards in this district have between them building 19 vessels of about 43,000 tons, three of which will be engined at Port Glasgow. The strike of riveters at Greenock, which was referred to in last month's notes, is, so far as concerns the yard of Messrs. Russell & Co., at an end, the men accepting the advance of 9d. per 100 rivets offered by their employers. The riveters in the employment of Messrs. Caird & Co., who are busily employed with the two large P. & O. steamers, however, still remain out, and on the 15th of the month they were joined by the men belonging to Messrs. Scott & Co.'s yard. The latter firm, however, conceded an advance of 9d. per 100 rivets and the men have resumed work.

The new Inman Liner, *City of New York*, presently in course of completion by Messrs. J. & G. Thomson, was towed to Glasgow a fortnight ago in order to get her machinery on board. There are some parts of the machinery of this large vessel which can more easily be placed in position by a crane, and notwithstanding the great power of the sheer-legs at Messrs. J. & G. Thomson's works at Clydebank, it was found more expedient to take the vessel to Glasgow, there to have the use of the crane, which is one of the most powerful in the harbour. When returning from the harbour two days later, and while being towed into the tidal dock at Clydebank, her bowsprit came accidentally into contact with one of the sheer-legs, forcing it over, and dragging the other two with it into the dock. Fortunately, none of the workmen in the shipyard were at work, or the consequences might have been more serious. As all the lifting in connection with the ship is now finished, no inconvenience will be felt by the firm in the completion of the work on board, though it will be some weeks before the sheer-legs can be replaced in their position.

Messrs. W. Beardmore & Co., Parkhead, Glasgow, have lately obtained a very important Spanish contract. This is for the steel boiler plates required for the two twin-screw cruisers, which are being built for the Government of Spain, at Barcelona. These vessels are rather larger than the *Reina Regente* which was recently built by Messrs. J. & G. Thomson, of Clydebank. Messrs. Beardmore are also to supply the crank-shafts for the engines, each of the four weighing 65 tons of steel.

Messrs. Merry & Cunningham have resolved to add to their extensive operations at Glencarnock the manufacture of steel by the Siemens-Martin process. Already steel by the Thomas Gilchrist process is largely produced there.

A good many new vessels have been changing ownership lately, while still in the hands of the builders. The s.s. *Spindrift* already referred to as having been built by Messrs. Russell & Co. was purchased from the original Sunderland owner before the launch, by a London firm of owners, and the *Camphill*, a cargo steamer of about 2,000 tons register, recently built by Messrs. Russell & Co. for Messrs. Macbeth & Gray, shipowners, Glasgow, has been purchased from the owners by another Glasgow firm, who have changed her name to *Schiehallion*. She is at present being fitted out at the James Watt Dock, and will shortly be ready to proceed to sea. The large sailing ship, of some 2,200 tons register, which Messrs. Russell & Co. laid down some time ago on builders' account, has been bought by Mr. Rickmers, of Bremerhaven, for whom that firm lately built the four-masted ship *Renee Rickmers*. The vessel is almost ready for launching.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—The shipbuilding trade of the Tyne, of which we were able to speak in such hopeful terms in previous reports this year, is just now almost completely dislocated by one of those wages disputes which are, too often, the accompaniments of improving trade. The platers' helpers at Messrs. Palmer's Jarrow Yard came out on strike some four weeks ago for an advance of 3s. per week in the rate of wages, the existing rate being 25s. per week. The firm finding it impossible to concede this advance, and failing to induce the helpers to return to work, even by the promise that an application for an advance would receive consideration if made later on in the year, were under the necessity of bringing the matter under the notice of the Tyne Shipbuilders' Association, with a view to securing the assistance of that body in the very difficult circumstances in which they found themselves placed. The Associated Shipbuilders accordingly issued notices to the helpers in their employment terminating their engagements on the 19th ult., unless in the meantime the claim of Messrs. Palmer's men for an advance was withdrawn. This not having been done, the notices took effect on the date named, and, as a consequence, the helpers in nearly the whole of the Tyneside yards are now "looked out." The number of men directly concerned in the dispute is about 1,500, but a very much larger number will almost immediately be laid idle through the absence of the helpers, unless substitutes are found to fill their places, or a general settlement is brought about. In the case of the Jarrow dispute a number of men have already been procured to occupy the places of the strike hands, and failing an early adjustment of existing differences with their late workmen, it is more than likely that the other shipbuilders on the river will adopt similar means of manning their establishments. Sir C. M. Palmer, M.P., the head of the great Jarrow firm, stated on a recent occasion that they had to break off negotiations in which the acquisition of a £30,000 contract was involved, on account of the strike, and they had, for the same reason, to abstain from tendering for other large contracts, which they would have every chance of securing. It will thus be seen what a disastrous affair this trade dispute is to the Tyne district, and the circumstance should enforce the lesson, that efforts should be made by those concerned to provide for every district permanent arrangements for the amicable settlement of such matters. In connection with the Jarrow dispute, it is a matter greatly to be regretted that the respected head manager of Messrs. Palmer's establishment, Mr. John Price, has been indisposed since the commencement of the difficulty, and is still unable to attend to business. If he had been to the fore it is in the highest degree probable that the dispute would not have attained the very serious dimensions it has now reached. Messrs. Armstrong, Mitchell & Co. have commenced the construction of a large oil-carrying steamer at their Elswick yard. It now seems certain that, in the absence of orders for war vessels, the firm will continue the building of merchant vessels at this establishment, which has hitherto been devoted exclusively to the first-named class of work. In addition to the large amount of new work in hand at Messrs. Hawthorn, Leslie & Co.'s establishment, the firm are enabled to keep their graving dock—which, it may be stated, is one of the largest in the kingdom—pretty constantly occupied with vessels requiring repairs. The trial trip of a steamer built by this firm for the China trade took place recently and was most satisfactory in its results. Messrs. Stephenson's yard, Hebburn, and Messrs. W. Richardson & Co.'s, Low Walker, are unaffected by the present dispute,

the proprietors having decided to act independently of the Shipbuilders' Association. The repairing establishments at Shields are also in full work, the men employed in them being content now, as on former occasions, to abide by any wages settlements accepted by those engaged at new works in the shipbuilding establishments up stream. The marine engineering establishments continue to show a great pressure of work, and most of the departments are still kept working double shift. Messrs. Hawthorn, Leslie & Co. have some special contracts in hand at their St. Peter's works for the Admiralty, and in this instance very exceptional briskness is exhibited. The North Eastern Engineering Company, Wallsend, have discontinued night work in their boiler shop, but it is expected to be resumed as soon as contracts in the fitting shops are a little further advanced. Messrs. Baird & Barnsley, of the Bull Ring Engine Works, North Shields, are now engaged in engining a locally-built steamer, and have other contracts of considerable importance in progress. Messrs. Donkin & Nicholl, of the St. Andrew's Engine Works, Newcastle, have the contract for supplying electric bells and ventilating fans to the s.s. *Alfonso XII.*, recently launched at Low Walker. The firm have a great many orders for steering gears and other specialities, and their establishment is kept in full operation night and day. At the Elswick Ordnance Works some large orders have just been obtained, and an increase in the number of hands employed is expected to take place immediately. The well-known firm of Messrs. George Angus & Co., leather and india rubber manufacturers, has just undergone the change customary nowadays in the cases of all successful business concerns. It has been changed to a limited liability company, and it need scarcely be stated that the shares were no sooner offered for public acceptance than they were taken up. The newly formed company will start under most auspicious circumstances, as the engineering trade, upon which their business largely depends for its healthful development, is now very prosperous, and orders for specialities connected therewith are being received in large numbers.

The Wear.—Since last month some incidents especially worthy of note have taken place in connection with the shipbuilding trade of the Wear. Chief among these may be mentioned the recommencement of operations in Messrs. Priestman & Co.'s yard, which has been closed almost without intermission since 1884. The firm are about to lay down two vessels of tolerably large dimensions, one of which will be built to order and the other as a speculative enterprise. Another incident of more than common interest was the arrival in port of the once famous French liner, named the *Ville de Paris*. The vessel has been purchased by a local gentleman, and after the necessary surveys are completed will probably be put through a process of thorough repair and supplied with engines and boilers of the modern type. Messrs. Pickersgill have secured an order for a large steamer within the month, and Mr. James Laing has contracted with a foreign company to supply a vessel almost as large as that mentioned in last month's report as having been ordered by the British India Steam Navigation Company. Business at Messrs. Short Brothers' and Messrs. Doxford's yards is still very active, and at Messrs. Austin's yard there is a decided increase of work. Messrs. J. L. Thompson & Son's yard, North Sands, must still be described as the busiest in the district. The six building berths are constantly occupied, for as soon as a vessel is launched the keel for another is immediately put down. This, at all events, has been the case during the present year and a good portion of last year, and a similar state of things is likely to be noted for some months to come. By the time this is in print Messrs. Bartram & Haswell will have launched the *Maple Branch*, a particularly fine steamer that has been built to the order of a local company. The firm have another vessel in the plating stage, and are receiving the material for a third. The Sunderland Shipbuilding Company are now actively pushing on the construction of some large vessels, the keels for which were laid towards the close of last year, and at all the remaining establishments, excepting Messrs. Osborne and Graham's, North Hylton, a fair amount of activity is to be noted. Mr. John Dickinson, of the Palmer's Hill Engine Works, has contracted to supply the engines and boilers for an exceptionally large vessel about to be laid down by Messrs. J. L. Thompson & Sons. There are a great many other contracts in progress, and orders for Dickenson's patent crank shaft form a substantial addition to the other work in hand. At the Southwick Engine Works some important orders for engines of large power have also been received. There is a good deal of work in progress at Messrs. Doxford's establishment, Pallion, and at the North Eastern Works, South Dock, business remains active. The new Scotia Engine Works are now so far advanced towards completion that a commencement of engineering operations in the month of August is anticipated. Forges and foundries are still quite full of work, and the local iron-works continue to show greatly improved business.

The Hartlepools.—Launches have taken place during the month from both Messrs. Gray's and Messrs. Withey's yards, and the places of the vessels put off the stocks have been filled by keels for others. Repair work has been pretty plentiful lately, and has formed an important addition to the new contracts in hand at the different establishments. In marine engineering business is still very brisk, and the local ironworks are kept regularly going.

The Tees.—The shipbuilding establishments at Middlesbro' and Stockton are, with one or two exceptions, well supplied with orders, and marine engineering shops are as busy as could be desired. In other branches of engineering, however, the state of business is not so satisfactory. Bridge works and boiler works are fairly busy, and in the iron and steel trades the improvement noted in previous reports is maintained. Shipments of pig iron from Middlesbro' have been unusually heavy this month, and this circumstance is justly regarded as a hopeful one for the future.

THE MERSEY.

SHIPBUILDING at this centre still remains very inactive, orders being exceedingly scarce and prices hardly remunerative.

Messrs. Laird Brothers launched during the last month the *Quito*, which has been built to the order of the Pacific Steam Navigation Company, and which is intended for their trade in the West Coast of South America. She is in every way fitted for the trade for which she is built, her cabin accommodation being specially roomy, with all the state rooms forward of the engines, thus ensuring them free from any of the objectionable odours that are usually experienced when the cabins are aft. Messrs. Laird have a sister ship on the stocks for the same company, which they hope to deliver about the end of next month.

The accounts of the Pacific Company have only just been published, and they are barely of such an encouraging nature as the shareholders could desire. The profits, after providing for depreciation and insurance, are almost *nil*, and the dividend that has been declared is only paid out of the insurance fund that this company has prudently accumulated. The directors of the Pacific Company are wise and shrewd men of business, and we are therefore led to believe that they must anticipate a speedy rise in the cost of new tonnage, otherwise we feel sure they would hardly have ventured on building the steamers now in hand, when their accounts indicate that their present fleet cannot be profitably employed.

Messrs. R. & I. Evans have just laid the keel of a sailing ship for Messrs. S. Wakeham & Son, of Liverpool. She will be employed in the general trade, and is expected to be ready for launching about the end of the year.

One of the new Manx companies, which started in opposition to the "old" company last year, has come to an untimely end. The only steamer that the company possessed was offered for sale by Messrs. C. W. Kellock & Co., of Liverpool, at their auction rooms, Rumford Street, but as the price offered, viz., £10,100, was below the reserve figure, she was withdrawn, and will now, probably, be sold by private treaty.

These are hardly the days for fresh enterprises in the steam trade. Indeed, the tendency is now rather the other way. Only very strong companies can increase, or even maintain, their present fleets. The Huntingdon Line of steamers, that ran in connection with the Chesapeake and Ohio Railroad, has ceased to exist as a line. The trade has hitherto been maintained by the steamers *Duke of Buckingham*, *Duke of Westminster*, *City of Manchester* and *Florida*, between Liverpool and Newport News, calling at Queenstown, but the opposition of the "tramps" has forced the directors to take the extreme measure of withdrawing their boats entirely from the trade.

The freight market from America is absolutely without life. Whatever freight be on the market is actively competed for by the different passenger companies, who will accept merely nominal rates so as to avoid the necessity of buying ballast for their homeward voyages. The Bombay homeward market is also without any encouragement for the shipowner, and the best month of the whole year (May) has seen the abnormally low figures of 17s. 6d. accepted for open charter. Time was when the steamship owner

might rely, on the close of the Bombay season (which occurs either in May or June, according to the date when the monsoon breaks on that coast), on witnessing a smart upward movement; but the last few years, and this year more especially, things have gone from bad to worse. There is no doubt that this is almost entirely due to the new type of cargo vessels that the Bombay trade has produced. Steamers that will lift 5,000 or 6,000 tons are the only boats that can exist at the rates that are now current, and the rapid increase in the number of vessels of the size named, preclude any hope of improvement in the near future. The only ray of comfort for the shipowner comes from the Black Sea, where rates have not only been maintained, but have steadily improved during the month, and there seems to be every reason to believe that for some time to come remunerative freights will be current both from the Azoff and the Black Sea. Outward freights eastward continue firm consequent upon the depressed state of the homeward market, and there cannot be much fall outwards whilst homeward business continues to be so stagnant.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Zeta.—On April 24th Messrs. Joseph L. Thompson & Sons launched from their North Sands Shipyard a steel steamer of 3,400 tons deadweight capacity, built to the order of Messrs. Turner, Brightman & Co., of London. The vessel is of the raised quarter-deck type, and web-frame construction, built under special survey for the 100 A1 class at Lloyd's, and is fitted with Emerson, Walker & Co.'s patent direct-acting windlass. The engines are of 200 H.P. nominal, and are being built by Messrs. Blair & Co., of Stockton, and are of the triple-expansion type. The ceremony of naming the vessel *Zeta* was performed by Mrs. Turner, of London. The *Zeta* has been, during construction, under the supervision of Captain Harrison, of Bristol, and the engines under the inspection of Mr. P. M'Cabe, on behalf of the owners.

Jeannette.—On April 26th Messrs. Cochron & Co., steam yacht builders, of Birkenhead, launched from their Bridston wharf a steam yacht of the following dimensions:—Length over all, 117 ft.; length on water line, 106 ft.; beam, 17 ft.; depth, 10 ft. 8 in. The yacht, which was gracefully christened *Jeannette* by Mrs. Platt, is built to the order of Frederick Platt, Esq., of Barnby Manor, Newark, and is designed by St. Clare J. Byrne, Esq., of Liverpool, who has also superintended the construction. She is fitted with triple-expansion machinery, having cylinders 11 in. and 17 in. and 28 in. diameter and 20 in. stroke.

Wilcannia.—On April 27th Messrs. Wigham, Richardson and Co., launched from their yard at Low Walker, a steel steamer, 325 ft. in length, 40 ft. broad, and 28 ft. 9 in. deep. The vessel is built on the three-deck rule, and has a poop, bridge, and top-gallant forecastle, and will be rigged as a three-mast schooner. She will carry about 4,000 tons of cargo, and is intended for the Australian Line of Mr. W. Lund, of London. Besides having six steam winches and every facility for loading and discharging cargo, she has one of Emerson, Walker & Co.'s patent horizontal direct steam windlasses. She has accommodation for first-class passengers in the poop, and side-lights all fore and aft in the 'tween decks, so that she may carry troops or emigrants. The triple-expansion engines, also constructed by Messrs. Wigham, Richardson & Co., are on Tweedy's patent system, as is usual with the engines built by this firm; they will indicate about 2,000 H.P., and will drive the vessel when loaded at about 11½ knots. The vessel is built to the order of Mr. W. Lund, of London, and is being fitted out under the superintendence of Captain Mackenzie, and the engines are being surveyed by Mr. Andrew Thompson, of London. The vessel was christened the *Wilcannia* by Miss Lund.

St. Oran.—On April 27th Messrs. Simpson, Strickland & Co. launched from their yard at Sandquay, Dartmouth, a wooden steam launch diagonally built, named the *St. Oran*, built to the order of Mr. Robert Birkbeck for use on the west coast of Scotland. She is 58 ft. long by 9 ft. 6 in. beam, fitted with Messrs. Simpson, Strickland & Co.'s newest type of quadruple expansion machinery (Kingdon's patent), with a steel boiler for a working pressure of 200 lb. on the square inch.

Inverallan.—On April 28th Messrs. Richardson Duck & Co. launched from their building yard at South Stockton a steel screw steamer of the following dimensions:—Length over all, 240 ft.; breadth, extreme, 33 ft. 3 in.; depth of hold, 15 ft. 1 in.; tonnage, gross, 1,260 tons. The vessel, which has been built to the order of John Mair, Esq., of Glasgow, has a long raised quarter-deck, bridge house over engine and boiler space, a topgallant forecastle, and a half poop. She is built to the highest class at Lloyd's, on the cellular principle, the double bottom containing 340 tons of water ballast. The outfit includes all modern improvements for a first-class cargo steamer. The engines, 17 in., 28½ in., 46½ in., and 33 in., supplied by the North-Eastern Marine Engineering Company, Limited, Wallsend-on-Tyne, are expected to give her a speed of nine knots, with a deadweight carrying of about 1,800 tons. The vessel was named *Inverallan*.

Brenner.—On April 28th there was successfully launched from the yard of Messrs. William Doxford & Sons, Pallion, the fine new screw steamer *Brenner*, built to the order of Messrs. Cay, Hall and Company, of South Shields, for the general trades, and is entirely of steel, built to Lloyd's 100 A1 class. The principal dimensions are:—Length between perpendiculars, 265ft.; breadth, 37 ft.; depth moulded, 18 ft. 6 in., with cellular bottom fore and aft, the vessel carrying 2,600 tons on 18 ft. The engines are triple-expansion three cranks, with all Messrs. Doxford's latest improvements, the cylinders being 20 in., 33 in., and 54 in. diameter respectively, and the stroke 36 in., and they are supplied with high pressure steam from exceptionally large boilers. She is fitted with Bow McLachlan's patent steam steering gear, Hastre's screw gear aft, four steam winches by Messrs. Welford Bros. of Pallion, patent multitubular donkey boiler by Messrs. Cochran, of Birkenhead, and all the most recent improvements for cargo purposes. The cabins are most tastefully constructed in teak, oak and mahogany in the poop aft, and give most comfortable quarters for captain and officers. The crew and firemen have exceptionally large and comfortable quarters at fore end of bridge. The christening ceremony was most tastefully performed by Miss Atkinson, of South Shields. The vessel has been surveyed during construction by Mr. Arthur Cay.

Tavistock.—On April 28th Messrs. Newall & Co., of the St. Philip's Iron Works, Bristol, launched the *Tavistock*, a steel screw tug, measuring 70 ft. by 14 ft. by 8 ft. 4 in. She is being fitted by the builders with compound surface-condensing engines, having cylinders 15 and 30 in. in diameter and 20 in. stroke, and a steel boiler 9 ft. 6 in. in diameter, and 9 ft. 3 in. in length, with Fox's furnaces, designed for 100 lb. working pressure, under Board of Trade survey. The owners are Messrs. D. Radford & Co., of London, and the vessel and machinery are being built under the inspection of Mr. Henry Adams, C.E., of Queen Victoria Street, E.C.

Quito.—On April 28th there was launched from Messrs. Laird Brothers' Works at Birkenhead a screw steamer, built to the order of the Pacific Steam Navigation Company, and intended for their West Coast trade. She was named the *Quito*, and was christened by Miss Timmis. The *Quito* is about 225 ft. long over all, with 35 ft. beam, and 22½ ft. depth to upper deck, and measures about 1,270 tons O.M. She is built of steel, with a complete steel lower deck. She has been designed to carry a large cargo, besides having space on main deck for cattle and deck cargo, and will be fitted with triple-expansion engines of 800 I.H.P., now nearly complete on the builders' premises. There will be accommodation in deckhouses on the upper deck for 60 first-class passengers, the state-rooms forward and dining saloon aft, in the latter being a mosaic floor of artistic design. There will also be provision for carrying a large number of steerage passengers. The vessel will be lighted throughout with the electric light, and fitted in every respect as a first-class passenger steamer, and will be provided with steam-steering and anchor gear, and all modern appliances. The *Quito* is the twelfth vessel built by Messrs. Laird for the Pacific Steam Navigation Company.

Rapel.—On April 30th a steel screw-steamer, of about 1,700 tons, and built to the order of Mr. Thomas Dewsbury, of Leeds, for the Compania Sud Americana de Vapores, of Valparaiso, was launched from the building-yard of the Blyth Shipbuilding Company, at Blyth. The vessel, which was named the *Rapel*, has been specially designed for the South American trade, and is fitted with steam windlass (Emerson, Walker & Co.'s patent). There will be fitted four powerful steam cranes and a steam winch, all made by Messrs. Robert Roger & Co., of Stockton-on-Tees, and a large multitubular donkey boiler working at a very high pressure for driving the cranes, &c., has been made by the Tyne Boiler Works Company, of Low Walker. The engines, which are of the tri-compound description, will be supplied by the North-Eastern

Engineering Company, of Sunderland and Wallsend. Immediately after the launch the *Rapel* was towed to Wallsend for the purpose of receiving her machinery. The christening ceremony was performed by Miss Kate Dewsbury, of Leeds.

Rosedale.—On May 1st there was launched from the yard of The Sunderland Shipbuilding Company, Limited, a steel screw steamer of the following dimensions and particulars:—Length, 180 ft.; breadth, 35 ft.; depth, 21 ft.; classed 100 A1 at Lloyd's, awning deck grade, having tri-compound engines 17 in., 28 in., and 46 in., and 30 in. stroke, by the North-Eastern Marine Engineering Company, Limited, Sunderland, working pressure, 160 lbs. per square inch. The vessel is fitted with three powerful steam winches by Messrs. Welford Bros., of Sunderland, and steam steering gear by Messrs. Donkin & Nichol, of Newcastle, Adamson's windlass. She is specially fitted throughout to meet the requirements of the Canadian Lake Trade, where she will be exclusively employed. The vessel has been built to the order of Messrs. Hagarty & Crangle, and has been inspected throughout by the latter gentleman and Mr. MacIntyre, of Glasgow. On leaving the ways she was named *Rosedale* by Miss Hands, of Sunderland.

Nymph.—On May 1st the new twin-screw composite sloop *Nymph* was successfully floated out of dock in the presence of a number of spectators. The ceremony of launching was performed by Miss Platt, daughter of the vicar of Holy Trinity, Portsea. A canopy was erected at the head of the vessel, which lay floating in No. 4 Dock, held back by hawsers. At a quarter-past 12 the *Nymph* was drawing 5 feet of water forward and 8 feet aft. After prayers were said by the Rev. Cox Edwards, dockyard chaplain, a bottle of wine, bedecked with flowers, was broken over the stem of the new sloop, and at the call of Admiral Superintendent Hopkins, three cheers were heartily given. The hawsers were then loosened, and the chain which held back the ship released by a blow from Miss Platt's mallet, upon which the latest addition to the Royal Navy slowly glided out of the dock into the ship basin.

Gellivara.—On May 7th there was launched from the shipbuilding yard of Messrs. C. S. Swan & Hunter, Wallsend-on-Tyne, a steel screw-steamer, built for the Anglo-Scandinavian Steamship Company, Limited, of London. The vessel is of the following dimensions:—Length over all, 340 ft.; breadth, 45 ft.; depth moulded, 24 ft. 3 in., and is built on the spar-deck type, of Siemen & Martin's steel, with longitudinal cellular double-bottom system, under special survey for the highest classification. The main saloon is amidships, and there is accommodation for 12 first-class passengers. The deck machinery consists of four double horizontal steam winches, and two special 20-ton derricks to facilitate loading and discharging, steam steering gear, and direct steam windlass. In addition to the usual oil lamps, the vessel will have a complete electric light installation, including large deck lamps to facilitate loading and discharging cargo at night, also a powerful arc search light. The vessel on leaving the ways was named *Gellivara*, and the ceremony was performed by Mrs. Wilkinson, of London. The *Gellivara* will be managed by Messrs. T. Skinner & Co., 103, Fenchurch Street, London, and is intended for the new trade of carrying ore from the port of Lulea, in the Gulf of Bothnia. The *Gellivara* is built to carry 3,300 tons on the light draught of 17 feet in fresh water at a speed of 11½ knots. She has great extra strength above Lloyd's ordinary scantling, is built throughout with web frames, and has capacity for about 4,000 tons of cargo. The engines are triple-expansion twin-screw, constructed by the Wallsend Slipway and Engineering Company (Limited), cylinders 18 in. by 28½ in. by 46 in., with 33 in. stroke, 160 lbs. pressure, and capable of developing 2,000 I.H.P. The building of the vessel has been superintended by Captain Campbell, of London, and the engines by Mr. A. Belham, consulting engineer, London. At the lunch which followed Mr. Hunter presided, and gave some interesting particulars as to the vessel and her destination. He said she was remarkable, because, being a vessel intended to carry large cargoes, she had nevertheless great speed and very small draught of water. She is also remarkable as the pioneer vessel of a large fleet. Mr. Hunter does not share in the prevalent belief that the shipbuilding industry is being overdone. He believed that the amount of tonnage now under construction is less, and not more than the world requires. He points to the fact that during the first three months of the present year there has been no increase, but, on the contrary, a certain decrease in the tonnage on the register of the United Kingdom. He considers the present a very favourable time for building, and that those who invest in steamships have every reason to expect their ventures to turn out profitably. Mr. Hugh Williams, chairman of the Anglo-Scandinavian Company, who followed Mr. Hunter, said that his directors had succeeded in constructing, through a difficult country, some 137 miles of railway, and had equipped it with rolling stock. They had also founded an important line of steamers. They had, in short, inaugurated a great new industry, which was full of promise for the future. He believed that the time was not far distant when a trade would be established between the Gulf of Ofoten and this country. A passage of only four days would suffice to bring immense cargoes of mineral from the mines, and the vessels might then be reloaded with British produce of the kinds needed in Norway and Sweden. It appears that several cargoes of ore are now lying at Lulea on the Baltic ready for shipment so soon as the navigation opens; but the place of shipment eventually intended is Victoria Haven, Ofoten Fiord, on the Norwegian coast, a locality which is never frozen up.

Jessmore.—On May 8th there was successfully launched from the shipbuilding and engineering works of Messrs. Oswald, Mordaunt & Co., a fine steel and iron screw steamer, built to the order of Messrs. W. Johnston & Co., Liverpool. Principal dimensions:—Length, 295 ft.; breadth, 40 ft. 3 in.; depth, 19 ft. 6 in.; class 100 A1 Lloyd's. The vessel is built with long raised quarter-deck and bridge, and topgallant forecastle. The accommodation for officers and engineers is fitted under bridge, with crew space at fore end of same. She has five steam winches for working cargo, and is fitted with Harfield's patent steam windlass for working anchors, Harrison's patent steam steering gear fitted at after end of engine room, and worked from wheel-house on bridge, screw gear in wheel-house aft, anchor crane on forecastle head. The engines and boilers are by the same firm, triple-expansion, with cylinders 21½ in., 36 in., and 61 in. diameter, with a stroke of 39 in., fitted with Joy's patent valve gear, three steel boilers; working pressure 170 lbs. During construction the ship and engines have been under the superintendence of Mr. Russell. The vessel on leaving the ways was gracefully christened *Jessmore* by Miss Oswald.

Partridge.—On May 10th the *Partridge*, screw composite gunboat, was launched from the new Ground at Devonport Dockyard by Miss Mary L. Grant, third daughter of Vice-Admiral H. D. Grant, C.B., Superintendent of Devonport Dockyard. The *Partridge*, which is a sister-ship to the *Pheasant*, launched at Devonport last month, was commenced in June, 1887, and is one of a class of vessels designed by Mr. W. H. White, director of naval construction. The frames of the new vessel are of steel, with an outer and inner sheathing of teak. She is of 755 tons, and is 165 ft. long by 30 ft., and her total cost, inclusive of machinery which has been made in the yard and armament, will be over £40,000. When completed she will have a complement of 100 officers and men, and will be propelled by a single screw. Her coal carrying capacity will be 105 tons, and when fully equipped she is expected to attain a speed of 13·25 knots an hour. Two new ships of a similar class, the *Lapwing* and *Ringdove*, are to be commenced forthwith at Devonport.

Magda.—On May 11th Messrs. W. Gray & Co. launched a fine steel screw steamer of the following dimensions:—300 ft. length overall, 38 ft. beam, and 22 ft. 2 in. depth, built to the order of Otto Trechmann, Esq., West Hartlepool, and classed 100 A1 at Lloyd's, and of 3,470 tons deadweight capacity. The vessel is of the well-decked type, with poop aft containing saloon and cabins for officers and a few passengers, long raised quarter-deck, long bridge of extra strength right up to fore hatch, and containing comfortable quarters for the crew. The usual topgallant forecastle is fitted forward with Emerson, Walker & Co.'s steam windlass-working patent stockless anchors. The hull is built on the web-frame principle, dispensing with hold beams, and giving a clear hold for working cargo. Five hatches are fitted, four steam winches, a steam steering gear, and two donkey boilers; double-bottom under each hold for water-ballast. The boats are carried on beams overhead, and the vessel will in every respect be well equipped for general trading. The engines, which are on the three-cylinder triple-expansion principle, are being supplied by Messrs. Blair & Co., Stockton-on-Tees. The vessel has been superintended during construction by Mr. J. Burns, on behalf of the owners. She was gracefully christened *Magda* by Miss Bertie Trechmann, daughter of the owner.

Othon Stathatos.—On May 12th there was launched from the shipbuilding-yard of Messrs. John Readhead & Co., West Docks, South Shields, a steel screw steamer, having the following dimensions, viz., 270 ft. by 36 ft. 9 in. by 18 ft. 9 in. The

vessel has been built to class 100 A1 Lloyd's, and is of the improved well-deck type, having long raised quarter-deck, bridge amidships extending forward, and topgallant forecastle. The engines and boilers with which the vessel will be fitted have also been built by Messrs. John Readhead & Co. The engines are on the triple-expansion principle, are of 200 N.H.P., and will be supplied with steam at a pressure of 160 lbs. from two large steel boilers. The steamer was named the *Othon Stathatos* by Mrs. Eftichia Hanos, of Ithaca, and has been built to the order of Messrs. Stathatos Brothers, of Braila, Galatz, and Sulina, and is the third vessel built for this firm by Messrs. Readhead.

Wileysike.—On May 12th there was launched from the yard of the Tyne Iron Shipbuilding Company, Limited, at Willington Quay, a steel screw steamer of the following dimensions:—Length 300 ft.; breadth, 38 ft. 6 in.; depth 24 ft. She is fitted with steam windlass, steam steering gear, and all modern improvements for the rapid loading and discharging of cargo. She will be fitted with powerful triple-expansion engines by the North-Eastern Marine Engineering Company, Limited, of Wallsend. On leaving the ways she was named the *Wileysike* by Mrs. W. J. Bone, of Tynemouth.

Shin Sheng.—On May 12th there was launched from the shipbuilding-yard of Messrs. William Pickersgill & Sons, Southwick, Sunderland, a steel awning-deck screw steamer of the following dimensions:—Length, 225 ft.; breadth, 33 ft.; depth, 20 ft. She has been built to the order of Messrs. G. & J. Weir, of Glasgow, on behalf of the China Merchant Steam Navigation Company, of Shanghae, to the highest class at Lloyd's. The vessel had been supplied with all the latest improvements, including steam windlass by Messrs. Clarke, Chapman, and Parsons, of Gateshead; steam steering gear by Messrs. Muir & Caldwell, of Glasgow; and two steam winches by Messrs. Welford Bros., of Pallion. The awning-deck is of teak throughout on which are the captain's and engineers' cabins. The accommodation for officers is under the awning deck aft, and the crew's berths are forward on the main deck. The engines, on the triple compound principle, are by Mr. George Clark, of Southwick, with cylinders 19 in., 31 in., and 51 in., and the stroke 33 in. Steam is supplied at 150 lbs. pressure from two boilers. She is also fitted with Messrs. G. & J. Weir's patent arrangements, consisting of feed heater, evaporator, feed pumps, and compound check feed valve. During construction of ship and machinery she has been supervised by Mr. R. Ranken, of Glasgow. The vessel, when leaving the ways, was christened the *Shin Sheng* by Miss Weir, daughter of Mr. G. Weir, of Glasgow.

Duke of Cornwall.—On May 12th Messrs. W. Gray & Co. launched a fine steel screw steamer of the following dimensions:—270 ft. length overall, 36 ft. 6 in. beam, 19 ft. 5 in. depth, and of 2,550 tons deadweight capacity, built to the order of the Duke of Cornwall Steamship Company, Truro, Messrs. J. and R. B. Chellew managing owners. The vessel, which will take Lloyd's highest class, is of the well-decked type, with a poop having saloon and cabins for officers and a few passengers, a raised quarter-deck, joining a long bridge, which is of extra strength, carried right up to fore hatch, and containing comfortable quarters for the crew. The usual topgallant forecastle is fitted forward, with Emerson, Walker & Co.'s windlass. The hull is built on the web-frame principle, dispensing with hull beams, and giving a clear hold for working cargo. Five hatches are fitted, four steam winches, steam steering gear, donkey boiler, and double bottom under each hold for water-ballast. The boats are carried on beams overhead, and a complete equipment provided for general trading. Five triple-expansion engines, of 750 H.P., and two steel boilers to work at 150 lbs. pressure per square inch, are being supplied by the Central Marine Engineering Company, West Hartlepool. She was christened *Duke of Cornwall* by Mr. R. B. Chellew, managing owner. The vessel and her machinery are being superintended by Mr. J. Williams, engineer to the Company.

Foam.—On May 12th a yacht was launched from the yard of Messrs. Slade & Sons, Polruan. She is built for Mr. Richard Foster, of Lanwithian, near Lostwithiel, and is to be yawl-rigged. Her dimensions are as follows:—Length of keel, 40 ft.; depth of hold, 7 ft.; beam, 11 ft.; length over all, 49 ft.; tonnage (builder's measurement), 22 tons. The yacht was christened the *Foam* by Mr. R. Foster, this being the name of his old boat.

Wylam.—On May 14th there was launched from the yard of The Sunderland Shipbuilding Company, Limited, a steel screw steamer of the following dimensions:—Length, B.P., 210 ft.; breadth, 30 ft.; depth of hold to top of floors, 15 ft.; classed 100 A1 at Lloyd's special survey, and is built with a raised quarter-deck and topgallant forecastle. Three steam winches are fitted by Messrs. Welford Bros., and patent windlass by Messrs. Harfield & Co. The machinery is of the triple-expansion three-crank type, having cylinders 16 in., 26 in., and 43 in., by 30 in. stroke, 150 lbs. pressure, and has been constructed by The North-Eastern Marine Engineering Company, Limited, Sunderland. The vessel has been built to the order of Messrs. Atkinson Bros., of Newcastle, and is intended for the general carrying trade. She has been inspected by Mr. Dykes. Upon leaving the ways she was gracefully named *Wylam* by Miss Atkinson, sister of the owner.

Lundy.—On May 14th Messrs. Richardson, Duck & Co. launched from their yard at South Stockton, a steel screw steamer of the following dimensions, viz.:—Length over all, 269 ft. 6 in.; breadth, moulded, 36 ft. 9 in.; depth in hold, 18 ft. 9 in. The vessel, which has been built to the order of Messrs. Farrar, Groves and Co., of London, has a long poop, with accommodation for captain, officers, and engineers, the crew being berthed forward in a topgallant forecastle. She is built to the highest class at Lloyd's, has a double bottom all fore and aft, on the cellular principle, capable of containing about 400 tons of water ballast. She is fitted with an Emerson-Walker patent windlass, and has a large Cestus donkey boiler, four horizontal steam winches, and every modern appliance for the quick loading and discharging of cargo. The engines, by Messrs. Blair & Co., Limited, of Stockton, have cylinders 21 in., 34 in., and 56 in., by 36 in. stroke, and are expected to give a speed of about nine knots. The christening ceremony was gracefully performed by Miss Hindley, daughter of Charles E. Hindley, Esq., of Eccles, Manchester, one of the owners, the vessel being named *Lundy*.

Steel Barge.—On May 15th Messrs. J. F. Waddington & Co. launched from their shipbuilding and engineering works at Seacombe a steel barge, built to the order of a Liverpool firm for the African trade. The barge is fitted with a steel deck, two large hatches, and a crane for working the same; is capable of carrying about 50 tons on four feet draft, and is a duplicate of four other barges, which the builders constructed last year for the same trade, and which have been very successful. Rapid progress is being made with a cargo and passenger steamer on order for the Mediterranean trade, and it is anticipated she will be ready in three or four months hence.

Maple Branch.—On May 24th there was launched from the shipbuilding yard of Messrs. Bartram & Haswell, the s.s. *Maple Branch*, built to the order of the Nautilus Steam Shipping Company. The vessel is intended to be employed in general trades. On leaving the ways the christening ceremony was performed by Miss Fanny Ritson. Among others present we observed the following:—Mr. Henry Ritson, Mr. and Mrs. Francis Ritson, Mr. and Mrs. W. Ritson, Mr. and Mrs. F. W. Ritson, Messrs. J. Davis, George Bartram, W. Browne, C. E. Morgan, W. Allan, W. B. Newton, and Captain Letbe. The vessel is built of steel on the spar-deck principle, with cellular bottom for water ballast, to class by Lloyd's register 100 A1. She is schooner-rigged, and is of 3,800 tons deadweight capacity, with full topgallant forecastle, fitted up with roomy quarters for the crew, and a long bridge amidships, under which berths are ranged for the accommodation of the engineers and officers. The principal dimensions are:—Length between perpendiculars, 300 ft.; extreme breadth, 40 ft.; depth of hold to top of ordinary floors, 28 ft. She is fitted with a direct steam windlass by Messrs. Napier Brothers; steam steering gear amidships by Messrs. Davis and Co., and five steam winches by Messrs. Clarke, Chapman, Parsons & Co., supplied with steam by a patent Victoria donkey boiler by the same firm. The engines are of the triple-expansion type, and are by Mr. John Dickinson; cylinders, 23¼ in., 38 in., and 62 in., with a 42-in. stroke; Workington feed, duplex Dowson ballast donkey pump, Kirkcaldy's feed water heater, and other modern improvements. There are two steel boilers of 160 lbs. pressure, fitted with Fox's corrugated furnaces, and Martin's patent furnace arrangements. This is the sixth steamer built by Messrs. Bartram, Haswell & Co. for the Nautilus Steam Shipping Company.

Drumburlie.—On May 24th there was successfully launched from Messrs. Robert Thompson & Sons, Southwick Yard, Sunderland, a steel screw steamer, built on the three-decked rule, to the order of Messrs. Gillison & Chadwick, of Liverpool. Her principal dimensions are:—Length, between perpendiculars, 305 ft.; breadth, 39 ft. 8 in.; depth of hold to Lloyd's floors, 25 ft. 7 in. She is built to class 100 A1 at Lloyd's under special survey. The

vessel has cellular bottom for water ballast, steel decks covered with yellow pine, large hatchways, four horizontal steam winches, and two donkey boilers, direct-acting steam windlass, steam steering gear, lighthouses on forecastle, and schooner rig. Accommodation for captain and a few passengers is provided for in full poop aft. The crew and firemen are berthed in top-gallant forecastle. The engines, which are tri-compound, having cylinders 23½ in., 38 in., and 62 in., with 42 in. stroke, have two double-ended boilers, 160 lbs. pressure, and are by the North-Eastern Marine Engineering Co., Limited, South Dock, Sunderland. On the vessel leaving the ways she was gracefully christened the *Drumburlie* by Miss Gillison, daughter of one of the owners.

LAUNCHES.—Scotch.

Spindrift—On April 25th Messrs. Russell & Co., Greenock, launched a steel screw steamer of the following dimensions:—Length, 320 ft.; breadth, 40 ft.; depth, 27 ft. 6 in., and of 3,000 tons net register. She has been built to the order of London owners for the Eastern trade and on leaving the ways was named *Spindrift*. She will be supplied in all departments with the latest improvements for navigation, and also for facilitating the loading and discharging of cargo. After being masted at the James Watt Dock she will proceed to Glasgow, where she will be supplied with triple-expansion engines by Messrs. Dunsmuir & Jackson.

Garland—On April 26th Messrs. Ramage & Ferguson, Leith, launched an auxiliary steel steam yacht, named the *Garland*, of 253 tons y.m., built to the order of the Hon. Mrs. Eliot Yorke, of London. The dimensions are:—Length 124 ft. 6 in., keel and fore rake; breadth, 21 ft. 6 in.; depth, 13 ft. 6 in., moulded. The yacht, which is classed 100 A 1 at Lloyd's, has steam windlass and all modern improvements. She has a large teak deck saloon adjoining the owner's state rooms aft, while forward are other four state rooms, and is supplied with triple-expansion engines. The owner performed the naming ceremony.

Trieste C.—On April 26th there was successfully launched from the shipbuilding yard of Messrs. William Simons & Co., Renfrew, a handsomely-modelled screw-steamer for passenger service on the Adriatic. Its dimensions are:—Length, 157 ft.; breadth, 21 ft.; depth, 11½ ft. The vessel is built of Siemens-Martin steel, under the superintendence of Lloyd's special survey. Saloon accommodation is provided at after end for first-class passengers, having ladies' cabin, lavatories, &c., and the panelling is of well-selected bird's-eye maple, pilasters and mouldings of mahogany, and cushions of Utrecht velvet. A second-class saloon is placed under main deck forward, and has sleeping accommodation for twenty passengers. Deck shelter for third-class passengers is provided under turtle-back forecastle. Electric light is fitted in the various cabins, engine-room, &c., and also for side lights. The engines are on the triple-expansion principle, and are expected to propel the vessel at a high rate of speed. The boilers are constructed of steel for a working pressure of 160 lbs. per square inch. As the vessel left the ways she was named the *Trieste C.*

Hopper Dredger.—On April 27th Messrs. William Simons and Co. launched at Renfrew one of their improved hopper dredgers, to carry 250 tons of its own dredgings. This vessel is specially designed to raise blasted rock at a port on the coast of France, the bucket chain and gearing being made of steel. The engines are compound surface-condensing of 250 I.H.P. The boiler is constructed for a working pressure of 90 lb. per square inch.

Madagascar.—On April 27th Messrs. Russell & Co., shipbuilders, launched from their Kingston Yard, at Port Glasgow, a four-mast sailing barque named the *Madagascar*. Her dimensions are:—Length, 283 ft.; breadth, 40 ft. 6 in.; depth, 24ft. 6 in.; net tonnage, 2,080, with a deadweight carrying capacity of 3,400 tons. The vessel, which was taken to the James Watt Dock, Greenock, where she will be fitted out, has been built to the order of Mr. J. W. Boyd, Helensburgh, and will load at Glasgow with a general cargo for Australia. She will be commanded by Captain M'Crone, of Rothsay.

Britannia.—On April 28th the Grangemouth Dockyard Company launched from their shipbuilding yard a steel twin-screw steamer, built to the order of the Morecambe Steamboat Company, Limited, of Morecambe, for their passenger trade. Dimensions:—120 ft. by 19 ft. by 8 ft. 6 in.; draught complete, 4 ft. She has all the latest improvements and convenience for first-class passengers, is rigged as a two-mast fore-and-aft schooner, and is built to the builders' own specifications and model. She is to be fitted with two pairs of compound surface-condensing engines by Hawthorn & Co., engineers, Leith. Cylinders, 12 and 24 by 18 in. stroke, and supplied with steam at 110 lb. working pressure by a large steam boiler, and is to steam a speed of 14 miles an hour. A water-ballast tank is fitted aft for trimming. She is built to the Board of Trade rules for their No. 3 certificate for home trade. On leaving the ways the vessel was named the *Britannia* by Mrs. Brown, wife of the secretary of the company.

Wooden Steam Launch.—On April 28th Messrs. Marr Brothers launched from their yard, at Leith, a wooden steam launch, 42 ft. in length, 9 ft. in breadth, and 5 ft. 6 in. depth, built to the order of the Northern Lights Commissioners. The launch is to be employed as a tender for the Isle of May and North Carr Lightships, and will be engined by Messrs. Hawthorn and Co., Leith.

Harold.—On April 28th there was launched from the shipbuilding yard of Messrs. Duncan & Co., Port Glasgow, a steel sailing barque of the following dimensions;—Length, 240 ft.; breadth, 36 ft. 6 in.; depth, 21 ft. 3 in. She is 1,360 tons gross register, and has been built to the order of Mr. W. A. Stephens, of London, under the superintendence of Captain R. Richards, of Liverpool. On leaving the ways the new vessel was named the *Harold* by Miss Duncan of Ardenclutha. After having her masts put in, and her fitting-out completed in the East Harbour, she will proceed to Glasgow to load a general cargo for San Francisco.

The Rose.—On April 28th Messrs. M'Knight & Co. launched from their shipbuilding yard at Ayr a screw tug of about 300 tons gross measurement for Messrs. Barnes, Guthrie & Co., Cardiff. Her dimensions are:—Length, 130 ft. b.p.; breadth, 23½ ft.; depth, 13½ ft. The vessel has been built under special survey class A1 in Lloyd's. The machinery, which is exceptionally powerful for a tug steamer, will be supplied by Messrs. Gilmour, engineers, Glasgow—engines, surface-condensing, of 130 H.P. nominal; cylinders, 29 in. and 25 in. diameter, by 36 in. stroke; boiler, 16 ft. diameter by 11 ft. long, with four furnaces, 38 in. diameter; working pressure, 80 lb. On entering the water the ceremony of naming the vessel *The Rose* was performed by Miss Sarah White, Glasgow.

Vreda.—On April 28th the Ailsa Shipbuilding Company launched from their yard at Troon a cutter-yacht for Mr. T. Hodgins, of Bray, Kingstown, from designs by Mr. G. N. Watson, Glasgow. Built of steel, she measures 60 ft. over all, 10 ft. in breadth, and 10 ft. 8 in. in depth. She is intended for racing in the 20-ton class, and measures 44 ft. 6 in. on the water line. Her model is very much after the style of the Thistle, and is fitted with every modern appliance for a complete racing yacht. On leaving the ways she was named the *Vreda* by Miss M'Murchie of Ayr.

Sung Kiang.—On May 1st Messrs. Scott & Co., shipbuilders and engineers, Greenock, launched a twin-screw steel steamer of 1,650 tons net register, built to the order of the China Navigation Company, and intended for the general coasting trade. On leaving the ways the new steamer was named the *Sung Kiang* by Miss Frances A. S. Scott, daughter of Mr. John Scott, C.B. The *Sung Kiang* is to be supplied by her builders with triple-expansion engines of 1,000 H.P. She is to be fitted out for sea in the Victoria Harbour, Greenock.

Wild Rose.—On May 1st there was launched from the yard of Messrs. John Fullerton & Co., at Paisley, an iron screw steamer of 250 tons gross, built to the order of Messrs. Richard Hughes and Co., of Liverpool, for their general coasting trade. Engines of 60 H.P., on the compound principle, will be supplied by Messrs. Hutson & Corbett, engineers, Glasgow. The steamer was named *Wild Rose* by Miss Hutson, of Glasgow.

Clacton.—On May 8th there was launched from the shipbuilding yard of Messrs. John Scott & Co., Kirkcaldy, a steel paddle steamer for the London and Clacton-on-Sea passenger service. The vessel on leaving the ways was named the *Clacton* by Mrs. Scott. The vessel was launched with all her machinery on board and her steam up, and sailed into Burntisland. Her dimensions are as follows:—Length, 195 ft.; breadth, 22 ft.; depth, 8 ft. 6 in. She is fitted with compound condensing engines of 150 N.H.P., and with all the most modern appliances for the comfort and convenience of passengers, and with Emerson, Walker & Co.'s patent direct-acting steam windlass for working wire-rope cable in addition to ordinary chain cable. The saloons are well ventilated, with a long promenade deck above. The vessel will be commanded by Captain Jones.

Eudora.—On May 9th a sailing ship was launched from the shipbuilding yard of Alexander Stephen & Sons, Dundee. The vessel, which has been built for the Messrs. Stephen themselves, is of steel, and her dimensions are:—Length, 280 ft.; breadth moulded, 40 ft. 3 in.; and depth moulded, 25 ft. 2 in. Her gross tonnage is about 1,976, and she will carry four masts. She has been fitted with all the latest improvements for embarking and discharging cargo, including patent steam capstan windlass by Emerson, Walker & Co., and the accommodation provided for the captain, officers, and crew is very commodious. On leaving the ways the vessel was christened *Eudora* by Miss Mary Stephens. Captain Marshall, late of the *Glenogle*, has been appointed to the command of the *Eudora*, which will be employed in Australian and general trading.

Inanda.—On May 9th there was launched from the shipbuilding yard of Messrs. Hall, Russell & Co., Aberdeen, a steel screw steamer, built to the order of Messrs. J. T. Rennie & Sons, Aberdeen and London. The vessel's dimensions are as follows:—Length over all, 280 ft.; breadth, 35 ft. 5 in.; depth, 25 ft.; and having a gross registered tonnage of 1,770. She has been built under special survey, to class 100 A1, being the highest class obtainable at Lloyd's, and has been fitted up with all the latest inventions that modern engineering has devised. The steamer is to be propelled by triple-expansion engines of 220 N.H.P., and two steel boilers, with a working pressure of 160 lbs. per square inch. She is fitted with water-tight compartments in fore and after holds, and a deep water-ballast tank has been so constructed in the main hold that it can be used for carrying cargo when required. Accommodation is provided for a large number of first-class passengers. The officers' berths, as well as the engineers', are placed under the bridge amidships, and those for the seamen and firemen forward. The vessel is lighted throughout with the electric light, supplied by Messrs. Holmes, of Newcastle. The christening ceremony was performed by Miss Madge Wilson, daughter of one of the partners of the shipbuilding firm, who named the vessel *Inanda*. The vessel was then towed to the sheer poles in the dock, where her iron masts, engines, &c., are to be put on board.

Cayor.—On May 10th there was launched from the dockyard of Messrs. Archibald M'Millan & Son, Dumbarton, a steel screw steamer, built to the highest class at Bureau Veritas, to the order of Messrs. Deves & Chaumet, of Bordeaux. Her dimensions are as follows:—255 ft. by 36 ft. 2 in. by 21 ft. 6 in. This vessel is intended for special navigation on the estuaries and bars on the West Coast of Africa, and is designed to carry 1,084 tons on a draft of 12 ft. She will be fitted with engines of the triple-expansion type by Messrs. David Rowan & Son, of Glasgow, having cylinders 20 in., 33 in., and 52 in., with a stroke of 36 in., the steam to be supplied by two cylindrical boilers, worked at a pressure of 150 lb.; I.H.P., 950. The speed expected to be attained is about 10½ knots. The vessel is fitted with double-bottom extending from the stokehole to the after peak bulkhead, and has special trimming tanks in the peaks to bring her to the correct draught for passing over the various African bars. She is fitted with Emerson, Walker & Co.'s patent steam and hand-power windlass. As an evidence of the rapidity with which work can nowadays be completed, the first frame of the vessel was turned on the 29th February. On leaving the ways the vessel was named *Cayor* by Mrs. Peter MacLellan, of Glasgow.

Magicienne.—On May 12th the first of the five swift cruisers authorised by Parliament last year was launched at the Fairfield Shipbuilding and Engineering Company's yard at Govan. She was named the *Magicienne* by Lady Pearce, and was built in the unprecedentedly short time of seven months. Her principal dimensions are:—Length, 265 ft.; breadth, 42 ft. extreme; and depth, 23 ft. moulded. Her displacement when down to her load draught will be about 3,000 tons, and she is expected to attain a speed of at least 20 knots. The hull is built of Siemens-Martin steel, and is divided into over 75 water-tight compartments. The inner bottom extends throughout the entire length of the engine and boiler spaces, and the flat of store rooms, magazines, &c., extends to stem and stern posts, thus giving a double bottom to the entire length of the ship. The spaces between the inner and outer bottoms are divided into 12 separate water-tight compartments, which can be used as water ballast tanks. The vessel has two complete decks, running fore and aft, and also platform decks, which cover the magazines, &c. The vessel will be lighted throughout by electricity, and has three powerful search lights on the cannon tower forward, and two aft on the upper deck on the sponsons. The armament consists of six 6-in. 5-ton guns, nine 6-pounder Hotchkiss quick-firing guns, one 3-pounder boat's gun, and numerous Nordenfeldt machine guns. She has six torpedo tubes or guns, and her stem forms a powerful ram. Her engines are of 9,000 H.P.

Banklands.—On Monday, May 14th, Messrs. John Reid & Company launched from their shipbuilding yard a handsomely modelled steel barque which has been constructed for Messrs. Wm. Just & Company of Liverpool. She will class highest at Lloyd's, and measure about 1,200 tons net register. Fitted with Emerson, Walker & Co.'spatent double-purchase capstan windlass. On leaving the ways she was gracefully named the *Banklands* by Mrs. Lilburn, of Glasgow. As she is a sister ship to the *Adderley*, launched by this firm last month for Messrs. C. W. Kellock & Co., of Liverpool, she will therefore be a large deadweight carrier, and under the able command of Captain Pierrepoint she should prove a very fast vessel.

Twin-screw Pleasure Yacht.—On May 14th there was launched at Albert Harbour, Greenock, a fine twin-screw pleasure yacht of the following dimensions:—Length, 45 ft. 6 in.; breadth, 9 ft. 4 in.; and depth, 5 ft. 6 in. She has been built, for sale, by Mr. John Thomson, boilermaker, Greenock. Her hull is of mild steel, and her woodwork of teak. Both fore and aft saloons are 6 ft. 4 in. in height, and will be fitted up with all the latest improvements and conveniences. Her boiler will also be of mild steel, and she will be engined, on the triple-expansion principle, by Mr. Robert Patrick, engineer, Greenock.

Baltimore City.—On May 15th, Messrs. Alexander Stephen & Sons launched from their shipbuilding and engineering works at Linthouse, a splendid steel screw steamer, 290 ft. by 39 ft. by 24 ft. and about 2,500 tons gross, built to the order of Christopher Furness, Esq., of West Hartlepool. The vessel has been built under special survey at Lloyd's for their highest class of 100 A1 three-deck rule, and is constructed with extra heavy main framing and longitudinal intercostals, dispensing with hold beams, thus giving large unobstructed holds for cargo. She has poop, bridge and topgallant forecastle. Accommodation is provided under bridge at fore-end for captain, with state-rooms for passengers, officers and engineers, all comfortably fitted up. The vessel has double bottom, on cellular principle, for water ballast and is fitted up with steam steering gear, steam winches and all modern appliances of the best description for the expeditious working of ship and cargo. The engines, which were fitted on board before launching are of the most improved triple-expansion type, having cylinders 21 in., 33 in., and 52 in. diam., by 42 in. stroke, with two steel boilers for a suitable working pressure of 160 lbs. As the vessel left the ways she was named the *Baltimore City*, by Miss Stephen of 12, Park Terrace, Glasgow.

Ceto.—On May 15th Messrs. Napier, Shanks, & Bell launched from their yard at Yoker a steel twin-screw yacht named *Ceto*, of about 180 tons y.m., built to the order of Sir Edward Cecil Guinness, Bart., of Dublin and London. The *Ceto* is 120 ft. by 18 ft., classing 100 A yacht registry, is fitted with Emerson, Walker & Co.'s patent horizontal direct steam windlass, steam steering gear, and is furnished and finished throughout in a superior manner, including a complete installation of the electric light. She has been designed and constructed under the superintendence of Mr. Edward B. Caird, Glasgow, and will be commanded by Captain H. Webb, of Gosport, sailing under the flag of the Royal Yacht Squadron. The engines, by Messrs. Dunsmuir & Jackson, are of the most improved triple-expansion description, to work by forced draught when required, and are expected to propel the vessel at a high rate of speed. The *Ceto* was named by Mrs. Caird.

Benledi.—On May 15th the steamer *Benledi* was launched from the building yard of Barclay, Curle & Co., Limited, at Whiteinch, where she has been built for Messrs. William Thomson & Co., of Leith. The *Benledi* is specially adapted for the tea trade, and will be an addition to Messrs. Thomson's fleet of Ben Line steamers trading between London and China. Her dimensions are 310 ft. by 38 ft. by 25 ft., and will register about 2,300 tons. After being launched she was towed to the harbour to be fitted by the builders with her engines, which are of the triple-expansion type, with all the latest improvements. She is fitted with a patent direct acting windlass, with capstan on upper deck by Messrs. Emerson, Walker & Co., London. The vessel was named by Miss Isa Thomson, daughter of Mr. Jas. W. Thomson, of Leith, one of the owners.

Lucille.—On May 16th there was launched from the shipyard of W. S. Cumming, Blackhill Dock, Monkland Canal, Glasgow, a steel screw yacht named the *Lucille*. The *Lucille*, which has been built to the order of Mr. John M'Andrew, Ferness, Largs,

is of the following dimensions:—63 ft. by 13 ft. 6 in. by 8 ft. moulded, and is classed 100 A1 at Lloyd's, yacht register. She has been specially designed and built for cruising, and in proportion to her size has extra large accommodation. The engines are of the triple-expansion surface-condensing type, having cylinders 7-11-18 by 12 in. stroke, with large steel return-tube boiler, working at a pressure of 150 lb. per square inch, and are fitted complete with all modern improvements.

Mavis.—On May 24th Messrs. J. Scott & Co., Kirkcaldy, launched from their shipbuilding yard a steel paddle steamer for the General Steam Navigation Company, for the Thames passenger service. The vessel is built of mild steel, is 215 ft. long, 26 ft. broad, with a draught of 9 ft. 6 in., and engines 250 H.P. She was named the *Mavis* by Miss Ellis, daughter of the company's marine superintendent.

LAUNCHES—GERMAN.

Gemma.—On the 7th of April, a new steel screw-steamer was launched from the yard of the Flensburg Shipbuilding Company, at Flensburg. She is built for Messrs. Holm & Molzem, in Flensburg, to class 100 A1 at British Lloyd's. Her dimensions are: 208 ft. by 30 ft. by 15 ft. 3 in. As she left the ways she was christened by Miss B. Molzem.

Helene.—On May 12th a steel screw-steamer was launched from the Flensburg shipbuilding yard. This vessel is built to the order of Mr. H. Schuldt, of Flensburg. She has raised quarter-deck, bridge, and forecastle, and a double cellular bottom. Her dimensions are:—203 ft., 30 ft. 6½ in., 14 ft. 3 in. 1st Div. Veritas. The engines on the triple-expansion principle 350 I.H.P. As she left the ways she was christened by Mrs. Petersen.

TRIAL TRIPS.

Valeria.—On April 18th the new passenger steamer *Valeria*, built by the Flensburg Shipbuilding Company, went on her trial trip in the Flensburg Bay. This steamer is built of steel to the order of Mr. A. Kirsten, in Hamburg, for the Hamburg Pacific Line and is classed 1st Div. Veritas. She has a cellular bottom and spar-deck, cabin for 30 first-class passengers under bridge, amidships. The 'tweendeck is fitted for emigrants. Her dimensions are: 296 ft. by 36 ft. by 25 ft. 7 in. Her engines, 1,350 I.H.P. are also built by the Flensburg Shipbuilding Company. On the trial a speed of 14 knots was attained, the engines working to entire satisfaction.

Biobio.—On April 19th, the twin-screw steamer *Biobio*, which has been built by Messrs. R. Napier & Sons for the Compania Sud Americana de Vapores, of Valparaiso, underwent her official trial at the measured mile, Skelmorlie, when the results were said to be satisfactory, and a mean speed of three-fourths of a knot in excess of the contract attained. This vessel has been built to the instructions of Mr. Thomas Dewsbury, Leeds, and has been specially designed to meet the requirements of the company's coasting trade on the Pacific, being intended to carry a large cargo on a light draught of water, with comfortable accommodation amidships for the passengers. The principal dimensions are:—Length 170 ft., breadth 32 ft., depth to awning deck 17 ft. 6 in., with a gross tonnage of 715 tons; built of steel, and classed at Lloyd's under special survey. The machinery consists of two sets of triple-expansion engines, and a single-ended steel boiler for a working pressure of 150 lb., with all the most modern improvements to attain efficiency and economy. At the trial a mean speed of 10·77 knots was attained at the lead draught, with a plentiful supply of steam, and a total absence of priming, heating, or vibration. After the trial the steamer returned to Glasgow to prepare for her voyage to Valparaiso, under the command of Captain W. Wakeley.

Birchfield.—On April 26th the s.s. *Birchfield*, built by Messrs. J. L. Thompson & Sons, Sunderland, to the order of Joseph Brown, Esq., Liverpool, went out to sea for her official trial. She is a fine steel steamer of 3,500 tons deadweight capacity, of the raised quarter-deck type. During her trial she attained a speed of 12½ knots. The engines and boilers are by Mr. John Dickenson, of Palmer's Hill Engine Works. The boilers are designed for a working pressure of 160 lbs. per square inch. The machinery has been designed and fitted with all the latest improvements to ensure the most efficient working on a minimum of wear and tear, and during the trial worked in the most satisfactory manner. The *Birchfield* has been, during her construction, under the superintendence of Mr. Thos. A. Reed, consulting engineer, Cardiff, on behalf of the owner.

Virginia.—On April 28th the screw steamer *Virginia*, which was recently launched by Messrs. Russell & Co., Port Glasgow, for Mr. Frederick Woods, of London, and engined by Messrs. James Howden & Co., Glasgow, had the trial of her machinery in the Channel. The *Virginia* is a steamer 290 by 38 by 20 ft. 6 in., built on full lines to carry 3,500 tons deadweight on a moderate draught. Her engines are of the triple-expansion type, having three separate cranks, the cylinders being respectively 22½ in., 37 in., and 58½ in. diameter, by 39 in. stroke, the valves being on Howden's patent arrangement. Steam of 160 lb. pressure is supplied to the engines by two single-ended boilers, 13 ft. diameter by 11 ft. in length, having each three furnaces 3 ft. 2 in. diameter. The boilers are fitted with Howden's patent system of forced draught. The steamer left Greenock Harbour about mid-day, and steamed down the Channel, but, owing to the strong wind and her draught not being enough to immerse the propeller sufficiently, it was found inadvisable to work the engines up to their full power. They were worked with easy steam to 88 revolutions, every part of the machinery working with smoothness and freedom from any tendency to heat. As it was impossible to try the forced draught properly on the two boilers owing to the engines being unable to use the steam, latterly one boiler was entirely shut off, the whole steam being supplied by one boiler from 38 square feet of fire-grate. This was found sufficient, with the forced draught, to maintain the engines at 80 revolutions per minute, which, with the immersion of propeller at the time of trial, gave 1,000 I.H.P. Satisfaction was expressed by the owners and their consulting engineer at the performances of the engines and the capabilities of the ship, which has Wasteneys Smith's patent "stockless" anchors fitted to stow up hawse pipes. The company returned to Greenock in the evening, and the ship proceeded to Cardiff to load for Bombay.

Pallas.—In May the S.S. *Pallas*, which has been built by Messrs. Raylton, Dixon & Co., of Middlesbrough, to the order of Messrs. Rathbone Bros. & Co., of Liverpool, for their Star Line of steamers, from Liverpool to Calcutta, made her trial trip from the Tees. The *Pallas* is of the following dimensions:—Length, 350 ft.; breadth, 42 ft.; depth, 28 ft. 9 in. She is a steel steamer, built on the three-deck rule, cabin accommodation being very handsomely fitted in a long house aft, with shade deck extending to sides of vessel, and containing handsome saloon paneled in marble, also music-room, smoking-room, and every other convenience, including marble baths, &c. The ship is lighted throughout with the electric light, fitted by the Liverpool Electric Supply Co., and is in every way a very handsomely fitted and well-finished steamer. The engines, which are on the triple-expansion principle, with cylinders 24 in., 40 in., and 66 in. diameter, by 48 in. stroke, have been fitted by George Clark, Esq., of Sunderland. The I.H.P. given by diagrams on trial being 2,512 and the speed 13¼ knots. The *Pallas* has been built under the supervision of Capt. Peel, the superintendent of their Star Line, and Mr. Ramsey, of Liverpool, has acted as consulting engineer for the machinery department.

Chaseley.—On May 1st the *Chaseley*, recently launched from the yard of Messrs. Murdoch & Murray, Port Glasgow, went her trial trip. This vessel has been bought by Messrs. Bates, Stokes, and Company, Liverpool, and is to trade with passengers and cargo on the coast of South America. She is 160 ft. by 23 ft. by 11 ft. 6 in. hold, classed 100 A1 at Lloyd's, and has been fitted with compound engines of 65 N.H.P. by Messrs. Dunsmuir & Jackson, Govan. After having compasses adjusted, the vessel was taken to the measured mile, when a speed of 10¼ knots per hour was attained. The owners were represented by Mr. William Glover, of Liverpool, who expressed himself much pleased with the vessel and her speed.

Boadicea.—On May 4th the *Boadicea*, Captain Curzon Lowe, made a three hours' full-power trial of her engines in the Solent, after undergoing a thorough repair by the dockyard authorities. As she had all her sea stores on board, in readiness for her departure for the East India station, her immersion was deep. The draught forward was 21 ft. 4 in., and aft, 23 ft. 11 in. Although the boilers primed slightly during the run, the mean results of the trial were deemed satisfactory. A speed of slightly over 14 knots was maintained. After swinging for the adjustment of her compasses the *Boadicea* returned into harbour.

Marmion.—On May 4th the steamship *Marmion*, belonging to the London and Edinburgh Shipping Company, made a trial trip in the Firth of Forth. The vessel has just undergone a thorough overhaul, and her furnishings have been completely renovated by Messrs. S. & H. Morton & Company. The weather being inviting and bracing, a large company was transported by tug to the steamer, which lay at anchor in the Roads. Among those present were—Messrs. Thomas Aitken, manager of the London and Edinburgh Shipping Company; R. Croall, of Craigcrook; W. A. Young (Messrs. Hawthorns & Company); M. Lobnitz, shipbuilder, Renfrew; Parker (J. & G. Thomson, Clydebank); Caldwell (late consulting engineer, Leith, Hull, & Hamburg Steam Packet Company); Watt (late of North German Lloyd's); Shaw (Gibson & Company, Leith); Messrs. Paulson & Darling, Lloyd's surveyors; Captains Hossack, Raison Fitzjones, and Mr. Risk. The *Marmion*, which was built in 1871, by Messrs. Lawrie & Co., Whiteinch, and supplied by Messrs. J. & G. Thomson, Clyde Bank, with engines of 48 in. and 82 in. by 36 in., with 65 lbs. pressure, has been greatly improved, and from the speed she made is believed to be the fastest boat of the fleet of London steamers. She has been provided by Messrs. S. & H. Morton & Co, engineers, Leith, with a set of triple expansion engines 26½ in., 42 in. and 67 in. by 45 in. stroke, with a working pressure of 160 lbs., and on her voyage down the Forth to the Bass Rock attained a speed of 16·4 knots, the engines working most satisfactorily and indicating 2,800 H.P. The boilers are fitted with Purves' patent flues, and the engines have all the latest improvements, including feed and bilge pumps and auxiliary tanks that may be utilised in an emergency. All the machinery has been introduced under the direct superintendence of Mr. Young, engineer to the London & Edinburgh Shipping Company, and showed a clear saving of 20 per cent. of fuel over the old machinery. The cabin accommodation has been enlarged to the extent of providing berths for 120 saloon and 120 second-class passengers. The cabins and state rooms have been tastefully decorated by Messrs. R. Hadden & Son, who are contractors for the whole of the painting work. The ladies' cabin is a delicate piece of artistic workmanship and harmonious colouring, the panelling being particularly chaste and effective. The vessel has been fitted with steam steering gear by Messrs. Alley & M'Lellan, and has one of Sir William Thomson's patent compasses on deck. She is furnished throughout with electric light by Messrs. J. T. Goolden & Co., London. The *Marmion* will be commanded by Captain George Thomson, one of our most popular Leith skippers. The furnishing work has been executed in a highly satisfactory manner by Messrs. Paterson, Smith, & Innes, Edinburgh.

Engineer.—On May 4th the *Engineer*, recently built by Mr. James Laing at Sunderland, to the order of Messrs. Tatham, Bromage, of London, went on her trial trip, attaining, under adverse circumstances, an average speed approaching 11½ knots, and on completion of the same she proceeded on her voyage to Norway. Her engines are by Mr. George Clark, on the triple principle, cylinders 18 in. by 28 in. by 43 in. This vessel is unique in construction, built to the design of Mr. Bromage for conveyance of large and heavy packages. She has an unusually large hatchway, in sections, and carries her own appliances for lifting in and out packages up to 50 tons weight. Her dimensions are:—200 ft. by 28 ft. by 15 ft. moulded depth.

Trieste C.—On May 5th the steel screw steamer *Trieste C.*, built by W. Simons & Co., Renfrew, for passenger service on the Adriatic, completed her official trials on the Firth. Her dimensions are as follows:—Length between perpendiculars, 150 ft.; breadth, 21 ft.; depth, 11½ ft. The trial of this vessel has excited considerable interest in shipping circles, from the high speed guaranteed by the builders with the limited dimensions at their disposal. The measured distance was run no fewer than twelve times, with and against strong wind and tide. The result was most satisfactory; a mean speed of 15·12 knots per hour was obtained, being 1½ knots over that contracted for. The greatest speed was 15 92 knots, which equals 18½ statute miles per hour. The owner has expressed his approval by awarding the builders a premium for excess in speed. The engines, which are of the triple-expansion type, worked with great smoothness, and were supplied with steam working at 150 lbs. working pressure. The trials were conducted with natural draught only. The following gentlemen were present:—Mr. Alex. Cesare, the owner; Mr. Julius Cesare, his brother; Captain Beneditti, Mr. Brown (of Wm. Simons & Co.), Mr. Hamilton (of Clyde Shipping Co.), Mr. Saunderson (of Lloyd's), Mr. Wm. Brown and Mr. A. Brown, Renfrew; Mr. Anderson, Glasgow; Captain Ponsonby and party, &c., &c.

Earl of Dunraven.—On May 11th the *Earl of Dunraven*, a new iron paddle steamer, built by Mr. J. T. Eltringham, Stone Quay, and engined by Messrs. Rennoldson, South Shields, left Shields Harbour on her trial trip. The steamer, which is 126 ft. long, and fitted with powerful surface-condensing engines, and also with the latest improvements, has been built to the order of a Cardiff firm, and will be engaged in the towing and passenger trade in the Bristol Channel. The trial gave the greatest satisfaction.

Britannia.—On May 11th the twin screw steamer *Britannia*, recently launched by the Grangemouth Dockyard Company, went down the Firth of Forth on her official trial trip. The vessel, which is built of steel, is fitted up throughout entirely for passengers, and has a No. 3 Board of Trade passenger certificate for home trade. Dimensions:—126 ft. by 19 ft. by 8 ft., flush deck fore and aft, with promenade on bridge deck, extending out to side of vessel and over engine and boiler space all round both decks. The engines are by Messrs. Hawthorn & Co., Leith, two pairs compound surface-condensing type; cylinders, 12 in. 24 in., with a stroke of 18 in. On the mile the vessel obtained the speed of 15¼ miles, with engines running at 212 revolutions per minute, being 1¼ miles more than that guaranteed by the builders. The vessel is built to the order of the Morecambe Steamboat Company, Limited, for their passenger trade at Morecambe, Lancaster, and Fleetwood, for which she has been built.

Roitlet.—On May 12th the steamer *Roitlet*, built and engined by the Canada Works Engineering and Shipbuilding Company, Limited, to the order of A. Valetta, Esq., of St. Vaast, had a most successful trial trip. She was fully laden and steamed for six hours, the engines working very smoothly and to the entire satisfaction of all concerned. She has been built under special survey to the Bureau Veritas first class, and is to trade between Havre and St. Vaast with passengers and cargo.

Guy Colin.—On May 12th the S.S. *Guy Colin*, which has been built by Messrs. Raylton, Dixon & Co., of Cleveland Dockyard, Middlesbro', to the order of G. E. Bowring, Esq., for the English and American Shipping Co., proceeded on her trial trip. She is built of steel on raised quarterdeck rule, with web frames and no beams in her hold. Cellular water ballast all fore and aft. She has long bridge, extending beyond the foremast, fitted at aft end for engineers and fore end for the crew, with short well and open T. G. forecastle. Accommodation for captain and officers under the bridge amidships. She has a short hood and house aft covering the steam steering gear. Her leading dimensions are:—Length, 300 ft.; breadth, 38 ft. 2 in.; depth, moulded, 21 ft. 9 in.; deadweight carrying capacity, 3,350 tons. Her engines having cylinders 23 in., 35 in., and 59 in., by 39 in. stroke, by Messrs. T. Richardson & Sons, of Hartlepool, worked most satisfactorily, and gave every satisfaction to her owners. On completion of trial trip she proceeded to Cardiff.

Harperly.—On May 14th the new screw-steamer *Harperly*, built by Messrs. John Readhead & Co., West Docks, South Shields, for Mr. William Wright, of South Shields and London, was taken to sea on her trial trip. The *Harperly* is built of steel, the dimensions being 300 ft. by 39 ft. by 20 ft.; will be classed 100 A 1 at Lloyd's, under special survey. The vessel is of the well-decked type, having a long raised quarterdeck, bridge amidships, and topgallant forecastle, and is built on the cellular bottom principle for water ballast. She is fitted with triple-expansion engines, 1,150 I.H.P., being supplied from two single-ended steel boilers, at a pressure of 160 lbs. The results of the trial were in every way satisfactory, an easy head of steam being kept throughout the trial, and the engines working very smoothly. After the compasses were adjusted several runs were made along the coast, and on the measured mile the mean speed attained was 11 knots. The *Harperly* proceeds to Genoa under the command of Captain G. W. Freeman.

Tynesider.—On May 15th the steel screw-steamer *Tynesider*, built by Messrs. Schlesinger, Davis & Co., Wallsend, for the Tyne Steam Shipping Company, went out for her trial trip. The weather was dull and threatening, but the *Tynesider* went through her trial in the most satisfactory manner. The measured mile was gone over several times, and though the vessel had a full cargo of general goods on board she attained a speed of 14½ knots per hour. The I.H.P. of the engines on the trial was about 2,400; the revolutions were 82 per minute, and the boilers showed a working pressure of 160 lbs. per square inch. After performing her allotted task between Hartley and Blyth, the *Tynesider* went on a trip southward as far south as Hartlepool, and re-entered the Tyne shortly before 6 o'clock. The *Tynesider* will travel

between Newcastle and London, making, with the *Royal Dane*, two boats the Company will have engaged in the London trade. She will be commanded by Captain Cracknell.

Orkla.—On May 15th the new steel screw steamer *Orkla*, 2,070 tons gross, which has been built by Messrs. S. P. Austin and Son, of Sunderland, to the order of a Leith firm, had a successful trial trip at sea. The weather being favourable, progressive trials of the machinery were made from 26 revolutions, giving 3·3 knots per hour, to 86 revolutions, giving a mean speed of 11·75 knots per hour, on two trials with 1,230 H.P. The machinery, which was supplied by Mr. George Clark, of Southwick, worked smoothly, and satisfaction was expressed with the vessel and her fittings generally. She is the fourth vessel constructed by the builders for the same owners. The vessel returned to Sunderland to take on board a cargo of about 3,000 tons of coals for Savona.

Gemma.—On May 15th the steel screw-steamer *Gemma*, built by the Flensburg Shipbuilding Company in Flensburg, made her trial trip. The dimensions are:—208 ft., 30 ft., 15 ft. 3 in., 100 A1 at Lloyd's. The triple-expansion engine, 450 I.H.P., is also built by the Flensburg Shipbuilding Company. The steamer is built on the well-deck principle to the order of Messrs. Holm and Molzen, in Flensburg, for regular coal trading between England and Flensburg. By a considerable low coal consumption an average speed of 10½ knots was attained.

Arcadia.—On May 16th the last of the four Jubilee steamers of the P. and O. Company, the *Arcadia*, went for her official trial trip at Belfast, where she has been constructed by Messrs. Harland & Wolff. On a trial extending over six hours an average speed of nearly 16 knots was realised. It may be mentioned that the *Arcadia* (which is a sister ship to the *Oceana*, constructed by the same firm of builders) is of 6,500 tons register and 7,000 H.P. She will carry 250 first and 159 second saloon passengers, and 3,880 tons of cargo. The vessel is lighted throughout by electricity, and every improvement that modern science and experience can suggest has been adopted for the comfort and security of passengers.

Taroba.—On May 16th the *Taroba* (s), of 5,000 tons, lately purchased from Messrs. A. and J. Inglis, Pointhouse, by the British India Association, was officially tried, with satisfactory results. On account of the recent lamented death of Mr. John Inglis, the proceedings were quite private, only a few gentlemen being present, and those all immediately concerned in the trial. The speed was on an average of a series of runs 15·65 knots, and the working of the machinery was characterised by perfect smoothness and freedom from heating and vibration. The *Taroba* sails for Brisbane, Queensland, in June.

Hereward.—On May 17th the steam tug *Hereward*, which has been built to the order of Messrs. T. Gray & Company, was taken on her trial trip, and in every possible way the trial was a satisfactory one. The completion of this vessel is of great importance to the shipping trade of Hull. She was launched a little over three weeks ago by Messrs. Cook, Welton & Gemmell, who built the vessel for Mr. C. D. Holmes, to whom the contract had been entrusted. She is the most powerful tug on the Humber to-day, having engines of 60 N.H.P. These are of the new triple-expansion type, which are not only effective, but more economical as regards fuel than any other class of engines. Steam is supplied from a steel boiler, having two furnaces, at a pressure of 150 lbs., and the maximum number of revolutions attained upon the trial trip was 120. The vessel left Hull shortly before eleven o'clock, having on board Mr. Gemmell, Mr. C. D. Holmes, Mr. W. Sage, Mr. John Gray, and Mr. George Gray (manager for the company), Messrs. Tulley, Mr. Newton, Mr. Hohenrein, besides several other gentlemen, friends of builders or owners. There was a strong S.S.W. wind, accompanied by a heavy rain, and both wind and rain continued during the whole day. With a full head of steam she entered upon her first run of the measured mile, having both wind and tide pretty well with her. She accomplished her first run in exactly five minutes, which was at the rate of twelve knots per hour, the contract speed in the smooth water of the river. On being put about to run against wind and tide, she was six minutes over the run, very satisfactory, considering that she was dipping her bows into the water. The run southward was a sort of teaser, and there was nothing for the passengers but to descend to the cabins or to get wet on deck, and most of them preferred the latter.

Red Eagle.—On May 18th the trial trip of this magnificent 300 ton steam yacht took place on the Firth of Forth with the most satisfactory results. Built to the order of Sir George Stucley, Bart., of Bideford, Devon, the *Red Eagle* is a noteworthy addition to the Royal Yacht Squadron at Cowes of which her owner is a member. Her builders' dimensions are 142 ft. 6 in. by 21 ft. by 12·3 moulded, and the engines are triple-expansion, having cylinders 13 in. and 21 in. and 34 in. diameter by 22 in. stroke, supplied with steam from a steel boiler working at 150 lbs. pressure per square inch. On the trial trip, with engines running 110 revolutions per minute, a speed of 11½ knots per hour was attained, and the machinery throughout worked with the greatest smoothness. The accommodation in this yacht is exceptionally lofty and well arranged, the principal state-rooms being forward and entering from a beautifully fitted deck saloon, while aft there are several other state-rooms with pantry, also dining saloon, which is fitted up in a most artistic manner. The *Red Eagle* is built of steel to the highest class at Lloyd's, with two fore and aft rigged masts, and has been built to the design of Mr. St. Clare Byrne, of Liverpool, while the machinery was superintended during construction by Mr. James Rode.

Serpent.—On May 23rd H.M. ship *Serpent*, 6, torpedo cruiser, returned to Devonport after a day's trial of her engines in the Channel. Commander Prickett, of the *Indus*, was in charge of the vessel, and Staff Commander James navigated the ship. Owing to the horse power attained being below the amount stipulated for in the contract, 4,500, the trial was not deemed satisfactory.

Virgo.—The new steam trawler *Virgo*, built by Earles' Shipbuilding and Engineer Company (Limited), for the Grimsby and North Sea Steam Trawling Company (Limited), has been taken on her trial trip. The vessel left Grimsby Docks with a large party of the directors and officers of the Trawling Company on board, the builders being represented by Mr. Dixon and Mr. F. H. Pearson. She was taken down the river to Spurn, and was then put about and run up the river again. The weather was very stormy, with a strong wind and a heavy sea, and thus every opportunity was given of thoroughly testing the seaworthiness of the ship and the efficiency of her machinery with the most satisfactory results, she proving herself a first-rate sea boat, and the machinery working admirably throughout the trip. Sail was also got on the vessel, and her powers as a sailer thereby tested. The new *Virgo* is almost a sister ship to the trawler of the same name sunk a short time back in collision, and has been built to replace that vessel. The leading dimensions are 96 ft. 9 in. over all, by 20 ft. beam, by 10 ft. 9 in. depth of hold, and she is classed 100 A1 at Lloyd's. Her machinery consists of a set of triple compound three-crank engines, having cylinders 11½ in., 17 in., and 30 in. diameter, by 18 in. stroke, and are supplied with steam of 155 lbs. pressure from a steel boiler of good size.

THE MANCHESTER SHIP CANAL.

THE work of construction along the entire length of the Manchester Ship Canal is proceeding very satisfactorily; and, in fact, the progress already made is remarkable, considering the many difficulties that have had to be overcome, and the numerous preliminary operations which were required to be undertaken. At Eastham the excavation of the rock bed is well advanced, and it may be mentioned as an important fact that there is every appearance of the foundations turning out quite as satisfactory as was expected. It is now established beyond doubt that the whole of the locks will be supported upon solid rock, which will, of course, be a very great saving in the cost of foundations. The formation of the first of the embankments between the canal and the estuary is just being commenced, and it is expected that several miles of these embankments will be in progress very shortly. At Pool Hall the excavations are also being pushed forward with great vigour, and the contractor has got into the rock, which he is now engaged in removing. At Ince, on the length between the lighthouse and the river Weaver, good progress is also being made. At Western Point and Runcorn, the contractor has completed his large yards and buildings, which have now got into full working order, and at this place a very large quantity of materials and tools has been

collected, ready for the commencement of actual operations. At several points between Runcorn and Warrington the work of excavation is proceeding with great rapidity, and upon this length Mr. Walker has, in addition to the ordinary steam navvy, a "Lubecken," or German, land dredger in operation, which, in the soft, sandy soil out of which the canal is here being cut, is doing excellent work, removing material at the rate of 10,000 or 12,000 square yards a week. All preparations are now being made for the commencement of the excavation on the site of the locks at Latchford, near which point the contractor has erected a small town of offices, workshops, and huts. At Thelwall the first of the projected river diversions is being carried out, and within a few months the river will be turned into a new channel; meanwhile, the excavations for the canal proper are proceeding rapidly, both at this point, at Rixton Heys, and upon the meadows opposite the village of Warburton, in the last-named cutting alone there being six steam navvies at work. The Islam division, owing to difficulties about the required land, has been the most backward of all, but now the possession has been obtained of a portion of the land, offices are being erected, the soil is being stripped, and shortly steam navvies will be at work at this point. At Barton, the site of the new locks, "Un excavateur du système Couvreux," another type of dredger, has just been started, and appears likely to prove a formidable competitor to its German rival. At this point a temporary diversion of the river has been executed to enable the existing river bed to be filled up at once. Above the village of Barton, and near Irwell Park, rock cutting is being pushed on, and the first of the many bridges connected with the canal is just being commenced, viz., that for carrying the new bridge to Trafford Park over the Bridgewater Canal. Cutting is also being proceeded with at a point near the Salford Sewage Works, and last, but not least, on the site of the Salford Docks very rapid progress is being made in the excavation of material. In some places the level of the foundations of the dock walls has already been reached, so that the concrete work will be commenced at no distant period.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

COLLISIONS AT SEA.

To the Editor of The Marine Engineer.

Sir,—In the Editorial Notes of the Marine Engineer for May, there are some interesting remarks on disastrous collisions at sea. Having had ten years' experience in steamers, five years of which as master, I beg to offer the following remarks on the subject, and hope they will not be out of place in your columns.

When two steamers have been crossing, I have often been astonished to see the vessel, which by the rules is required to keep out of the way, keep her course until within dangerous proximity to the other. It is well known that many collisions occur through the vessel that should have kept her course altering her helm to clear the other ship; but it is certainly a trying position for those in charge to keep their course, when they see a ship at no great distance steering directly for them, and apparently having no intention to alter her course. When both vessels alter their courses, in such a position, each intending to pass under the stern of the other, a collision is imminent.

Not only is there danger through the possibility of the steamer, which should keep her course, altering her helm, but accidents to steering gear and engines frequently occur, which must increase the chances of a collision, when steamers are in such close quarters.

The writer believes that great improvements could be made in the masthead and side lights, he having on many occasions seen the lights go out several times during the watch, through both defects in the construction of the lamps and in the trimming of them; and when meeting vessels he has often seen their hulls on a dark night before the regulation lights, especially towards daybreak, when no doubt careless persons neglect to trim them, because in a short time they will be taken in altogether.

I am, Sir, yours truly,

OBSERVER.

Port Talbot,
May 7th, 1888.

BREAKDOWN AT SEA.

To the Editor of The Marine Engineer.

Sir,—Having noticed in your valuable paper that you are willing to insert any information engineers would forward, who, like myself, were unfortunate enough to have a breakdown, I send this account of what happened to us in the *S. S. Fitzclarence* in December last. When 500 miles off Bermuda the crank pin bolts of the L. P. engine broke, breaking the cylinder cover into three pieces, cracking the piston, breaking the top of the two columns, bending the connecting rod, breaking the stuffing box gland, and stripping the nuts off the studs for the cover of the beam centre. As all the pumps were on the L. P. engine, the only thing that could be done was to repair the damage. I made a wooden cylinder cover with 2½ in. pitch pine planks, bolting a piece the same thickness across the planks, and another on top of that with a ring of 2 in. square packing inserted into it to act as a stuffing box fore tale rod. I put a strong beam across the top of engine-room hatch, catching the angle-irons, and four strong shores from beam to wooden cover, patched the piston with two ½ plates 5 in. broad, put liners below connecting rod to make up for the bend. As I had only one connecting rod bolt I put in a temporary bolt for the other, and made a band with 1 in. round iron to help the small bolt. I put a heavy stretching screw from bottom of cylinder to a strong angle-iron in front of tunnel, two strong shores from top of columns to deck beams, and a shore from cover of beam centre to deck. When we got a start everything went all right except that the cylinder was lifting ⅛ off the columns every revolution, but with care and plenty of oil we were able to steam into Bermuda without assistance, the engines going 33 revolutions per minute.

My reason for troubling you with this is that I think it may be of interest to some of your readers.

I remain, Sir, your obedient servant,

CHAS. MIDDLETON,
Chief Engineer.

MEAN PRESSURE OF A COMPOUND ENGINE.

To the Editor of The Marine Engineer.

Sir,—I have read with a great deal of pleasure the contributions to this paper of Mr. Williams on the Relation of Power to Speed. There is one point on which I am not sufficiently posted yet, and that is the different co-efficient used for each ship. Will Mr. Williams explain how it is got from ship's dimensions,

$$\text{Murray's Rule } \frac{\frac{2}{3}\,\text{IHP} \times 100}{\text{IMS}} = V^3$$

does not take into consideration the length of entrance, though it does the moulded form.

D. R.

Sunderland,
May 17th, 1888.

ENGINEERS AND MATES.

To the Editor of THE MARINE ENGINEER.

SIR,—Having lately returned from a long voyage, and as usual on my arrival, perused the back numbers of the MARINE ENGINEER, my attention has been particularly drawn to the copy of two letters which have been lately published in the "Shipping Gazette," one from "One of the Mates" and the reply thereto by Wm. F. Owens. Mr. Owens has very ably answered the "Mate's" letter, but with your permission, I should like to add a few remarks on the subject.

Mr. Mate considers that the chief officer should have the same wages as the chief engineer, thereby assuming that the duties and responsibility of an officer are as important to the owners, who are the people principally concerned, as those of a chief engineer.

That the officer's duties are onerous, I am quite willing to admit, but they cannot be compared with the duties and responsibility of a chief engineer. Let us consider the principal types of vessels in the mercantile marine, viz., the fast passenger and mail vessels, the regular traders, and the easy going "tramps," as Brother Jonathan calls them. In all these classes, and perhaps more particularly in the mail boats, the success of a vessel depends principally on her speed and equivalent consumption of coal, or in other words, depends largely on the chief engineer, certainly far more so than on the chief officer.

The captain of the last vessel I was in used to remark, that nowadays there were only "*two men*" in a steamship—meaning the captain and chief engineer—one as master of the entire vessel, as every sensible engineer will admit, and the other as master of the engine department and motive power of the vessel, and having as great responsibility as the captain.

I am afraid "One of the Mates" has more than the ordinary share of jealousy against the engineer, which is too often met with, and which is really very unjust, as in the course of time the mate becomes captain and then enjoys a higher salary and better accommodation than the chief engineer.

"One of the Mates" says, "If anything gives way, can or do they repair it?" In reply, I ask him by what right does he insinuate such an utter falsehood, and then go on to assert that marine engineers are only capable of doing "patched up jobs" as he calls it? I am afraid he would be a "patched up job," if he expressed that opinion before an engineer; at all events, that one little sentence seems to me to show what a rancorous and jealous disposition he possesses. Farther on he adds that the officers require an association "to lift *themselves* up on a level with" the engineers, thereby acknowledging that from his own point of view the officers are inferior to engineers, and yet he wants the same money. I assume he did not mean what he wrote, but wants the money lifted, not the officers, as they are already higher up than we are, when on the bridge.

I have considered only the relative position of chief engineers and chief officers, as Mr. Owen's letter answers on behalf of other grades, and I thoroughly endorse what he has written.

Did "One of the Mates" ever have the pleasure of drawing the fires and crawling into a hot back-end, perhaps in the Red Sea, too, at that, and not a breath of wind on deck? If he had he might be inclined to think that Dante might have saved himself a deal of trouble in his description of the infernal regions if he had only said "Get into a hot back-end and there you have it." Or has our friend ever spent an hour or two in the bilges, after a tedious watch, endeavouring to clear the pumps and with the stoke-hold plates washed up? Yet these are not at all unusual pleasures of an engineer's life. I think if he ever had any real experience of an engineer's duties he would find them considerably harder than he would have us believe he thinks they are. I presume he has seen in the London *Daily Chronicle* of some months back, nearly two of the leading columns devoted to the position of engineers, and giving good reasons why the engineers receive more pay than the officers (for which may the editor's shadow never grow less).

For "One of the Mates'" especial benefit I should like to add, in conclusion, that I consider we, as a body, are far more kindly disposed towards the officers than they are to us, and that most of the trouble between engineers and officers is caused by some overbearing act on the part of the officers, who are too much disposed to look down upon us, because we are mechanics. I must say that I consider an educated mechanic to be a far more useful member of society in this nineteenth century than a man whose only qualifications are being able to handle and navigate a vessel.

However, I have always endeavoured, and with success, to maintain friendly relations with the "Deck," and many of my oldest friends are to be found amongst the officers, but I can assure Mr. "Mate" that making in public false and disparaging remarks on marine engineers is not calculated to promote a friendly feeling between the two classes. Rather let him pluck the beam from his own eye before he alludes to the mote which he seems to consider is in his brother's eye.

Yours truly,

ANTWERP, *May 3rd.* WM. ED. PROCTOR.

THE MARINE ENGINEERS' UNION.

To the Editor of the MARINE ENGINEER,

SIR,—I should not trouble you again, but for one sentence in the Hon. Chief Secretary's last letter, wherein, referring to mine of November, he writes: "I now proceed to keep my word by replying to that letter." He, however, does nothing of the sort, for he has not yet replied to a single one of the questions asked by me in November; first, it was my writing anonymously that prevented any reply being given, and now, after nearly four months' consideration, "the committee have decided," &c.

When I wrote you in November, I left two courses open to the Hon. Chief Secretary—first, either to have absolutely declined to answer my letter, whether written anonymously or not; or secondly, to have availed himself of the opportunity, and by answering fully all the questions asked, have secured for the "Union" the best advertisement it could ever have received in your columns. For some reason or another best known to himself, Mr. Leask chose neither of these courses, but preferred going off on a side tack about "stab in the dark," "reveals his name," &c.; and after all this delay and "high faluting," what do we get? Why, simply nothing.

As the Hon. Chief Secretary objects so strongly to the other parts of my first letter, will he now confine himself to categorically denying the sixth paragraph of it? or are we to take it that the "Union" is after all first and foremost a "trades' union," call it by whatever other name you will.

Although I have thus repeated one of my original questions, I am, of course, fully prepared to find "that the committee have decided that questions put by outsiders," &c. Convenient, certainly, but hardly satisfactory.

I fail to see why *my* modesty should be so much emphasised. From Mr. Leask's own showing he has only been able to secure, say, 1,500 members in twelve months, and as "it has been estimated that there are at least 40,000 marine engineers belonging to the United Kingdom, irrespective of those in India and the Colonies" (*vide* "the recognised official organ of the Marine Engineers' Union"), it is evident that even with such a past master in the art of advertising as Mr. Leask at the head of affairs, the Union has, so far, only received as members 3·75 per cent. of those eligible for membership. Now, what about the other 96 per cent.? Are they, I wonder, all so modest as to think the "Union" "does not adequately uphold," &c. I rather think the "collective wisdom" is somehow on the side of the 96 per cent. "Ye gods, &c." Surely Mr. Leask cannot be so innocent as to wish us to imagine that marine engineers are such highly trained beings as to be incapable of learning further? If he does, why so many marine engineer "crammers"? or does he think we are simple enough to believe that they are perpetually chained to their ships? If so, why clubs and club rooms in connection with the "Union"?

Again, I controvert what Mr. Leask states about marine engineers having "built" the engines they drive. I may, of course, be wrong, but I question if there are any chiefs of over 12 months' standing who have *taken part in* the construction of (there are more, I know, who have "built") a modern set of triple expansion machinery. Is the *ultima thule* of a marine engineer's training reached when he knows "*something* about the construction of the very engines," &c., and has been successfully crammed to pass the Board of Trade examination? I say no, not if he wishes to raise himself above his present position. I ask again, Have any papers been read before the "Union"? If so, why have they not appeared in your columns, for I take it your columns are just as much open to receive them as they are to receive papers of other societies? Surely the "collective wisdom" should have produced *a* paper, if not more, in twelve months. But stay; perhaps "the Committee have decided that" none of the "Union's" papers shall be given to "outsiders" Or perhaps the marine engineer of the present day is intellectually beyond the need of papers and their discussion, and yearns only for such information as his "coach" or "crammer" can impart to him; and if so, it is pleasing to see the forethought of the "Union" in

providing so many "Branch Offices" where this "yearning" can be readily satisfied. It may, of course, be (and undoubtedly we shall be assured that it is) only a mere coincidence; but the "coaching" interest certainly does seem to be strongly represented on the "Union" (and in "the Committee" also, I imagine). But there; "the Union being a *private* association, open to receive at least 40,000" members, any further remarks of mine "will be regarded as an impertinence." So now I will close with apologies for the length to which this has gone.

I remain, Sir, yours obediently,
F. SEATON SNOWDON.

London, S.W.

Miscellaneous.

An Air-Ship.—M. Jovis, the well-known aëronaut, is preparing an Atlantic air-ship, with which he hopes to cross from New York to some point in Northern Europe during the autumn. The balloon in question, which will be called the *Atlantic*, will be about 200 feet in height and have a cubic measurement of 25,000 metres. It will only weigh about 4,500 English pounds avoirdupois, and with the car, rigging, passengers, and apparatus about double that amount. The car will be square, and will be divided mid way by a wooden deck, above which will rise a quarter-deck, both being connected by a ladder. M. Jovis, who will be accompanied by M. Paul Arème, Lieutenant Mallet, M. Charpentier, and two other passengers, hopes to make 70 miles an hour. He may land in Norway or Sweden, if not in Ireland, in three and a half days after starting. Every conceivable accident is believed to have been provided against. M. Jovis does not hope that the scheme will have any immediate practical result. It is purely scientific, and will cost £8,000.

An Atlantic Jubilee.—During April the 50th anniversary occurred of what must be regarded as one of the decisive events in the world's history. On April 21st, 1838, the two steamships *Sirius* and *Great Western* arrived in New York Harbour from England, being the first steamers that crossed the Atlantic. The *Sirius* sailed from Queenstown on April 4th, the *Great Western* from Bristol on April 8th. Both arrived at New York on the same day, the latter vessel being behind the other by only a few hours. New York papers of the time gave vivid descriptions of the enthusiasm with which the vessels were received, and the crowds which witnessed their arrival. Captain Roberts, who commanded the *Sirius* on this eventful voyage, was three years later transferred to the ill-fated *President*, which was lost on her first voyage out, without leaving the faintest trace of her fate.

The French Cruiser "Cecille."—The Forges et Chantiers of the Mediterranean are about to launch the first-class cruiser, *Cécille*, at the Seyne, near Toulon, constructed on the plans of M. Lagane, formerly naval engineer, director of the shipyards of the Seyne. This vessel is of steel, with a double screw, and measures 122·50 m. long, by 15·03 m. wide, 10·69 m. deep. Her displacement is 5,776 tons. Her average draught of water will then be 6·03 m. The *Cécille* is protected by an armour deck, which protects her two engines, her boilers, ammunition, &c. Placed above the water-line, this deck descends by more than a metre below water at the stem and stern. Above this deck astern is a cofferdam, a succession of long compartments of steel running from end to end, and full of compressed fibre, which are intended to aid in keeping the cruiser afloat, should she be struck by projectiles. The propelling machinery consists of four vertical cylinder engines linked in couples, and having twin screws, which should develop 6,900 H.P. by natural draught and 9,600 H.P. by forced draught. The armament consists of six guns of 16 c.m. placed on the main deck, 10 guns of 14 c m. in the battery, four torpedo tubes, and a great number of revolving and rapid-firing guns. The *Cécille* will be lighted by electricity. Her net price, comprising the armament, is 8,220,000f., of which 2,900,000f. is for the engines and boilers. Ordered at the end of 1885, this cruiser should be delivered at the Arsenal, Toulon, on October 4th next. It will be seen, therefore, that she has taken less than three years to construct, a proof that construction can be performed as rapidly in France as in England. "The bad system of working which prevails in French arsenals," says the *Moniteur Industriel*, "is answerable for the delays which have arisen in fitting out the greater part of our war vessels for service." The *Cécille* will steam at 19 knots, and is manned by 486 men. This cruiser bears the name of a general officer who distinguished himself while in command of a division in the China Seas at the close of the monarchy of July.

Reviews.

Spon's Engineers' Price Book. London: E. & F. W. Spon.

The book now before us supplies a long-felt want and supplies that want in a practical and reliable manner. Briefly we may state that the book is an accumulation of very valuable data as to the cost of labour and materials, acquired as the result of many years' professional work in estimating for engineering contracts and iron shipbuilding. On retiring from the profession the idea suggested itself to the author that so much useful information, collected at considerable outlay of time and money, would prove a boon to younger or busier members of the profession, and we are decidedly of opinion that where prices are concerned the book will undoubtedly prove a "boon" to all engaged in engineering or shipbuilding.

In addition to the price book proper, the volume contains: extracts from Board of Trade Instructions to Surveyors, and from Lloyd's Rules; Rules for Crank-Shafts; Steel tests; Compound and Triple cylinder engines; Speed Tables, etc.; Samples of Specifications; Average hours of labour; Net cost of engines and hulls of steamers; Engineers' and Shipbuilders' charging rates; Wages rates, etc., etc.

As showing the scope of the book we may state that from the detailed cost of the hull of a steamship to that of a half-inch syphon, nothing appears to have been omitted; while the prices given in many instances being set down as for 1885 and 1887, allows of an easy comparison being made.

We have no hesitation in saying that the book should find a place in every engineering and shipbuilding establishment, and we are sure that no marine engineer could read the book without learning much from it that would be of interest and service to him.

Illustrated Catalogue of Steam Yachts, Launches, Barges, etc. Messrs. Vosper & Co., Portsmouth.

We have recently received a copy of the twenty-ninth issue of Messrs. Vosper & Co.'s catalogue.

In addition to portraying the different types of craft and engines as built by this well-known firm for the Admiralty and Foreign Governments, the present catalogue contains some very fine illustrations, together with brief specifications, of compound surface condensing and triple expansion engines, the latter ranging from pistons of 2½, 4¼ and 7 ins., by 5 in. stroke, to those of 12, 17 and 30 ins. by 20 in. stroke.

Prices, illustrations, and dimensions are also given of return tube boilers from 6 to 50 N.H.P., as are also those of multitubular boilers of from 2½ to 7 N.H.P. A very compact arrangement of twin-screw machinery having the engines attached to the boiler on each side is also shown. This type has been supplied to the English and Foreign Governments, and has in all cases turned out very satisfactory; while judging from its compactness, we should say it was a very suitable form for filling export orders. An illustration, dimensions, weight, and prices are also given of Vosper's patent 4-cylinder engines, together with boilers suitable for the same.

The latter part of the book is devoted to the prices and particulars of steam yachts, steam life cutters (as built for the English Admiralty), steam launches, of wood and steel, twin-screw launches and twin-screw barges.

In addition to the foregoing, the prices of donkey pumps and of a useful assortment of steam fittings is also given.

The present catalogue should be procured by all contemplating the purchase of small craft or machinery before coming to any decision in the matter, and we doubt not but what they will find in its pages satisfactory examples of that which they are in quest of, while Messrs. Vosper's name is sufficient guarantee that any orders entrusted to their care will be faithfully and satisfactorily executed.

The United States Navy.—Two cruisers under contract, known only as Nos. 4 and 5, are to be named the *Philadelphia* and *San Francisco*. In naming some new gunboats, the Secretary of the Navy has begun a new series, and the *Concord*, the *Bennington*, and the *Yorktown*, will commemorate the battles of the Revolution. Work on the cruiser *Baltimore* is progressing satisfactorily, and she will be ready for trial about July 1st. The cruisers *Newark* and *Philadelphia* have been laid down, and material for their construction is arriving fast enough to guarantee uninterrupted work for some time to come.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from April 20th to May 17th, 1888.

5893 R. J. Paris. Protecting ships' bottoms.
5898 W. Chadburn. Ships' telegraph apparatus.
5899 Do. Ships' engine room telegraphs.
5900 Do. Mechanical telegraphs for navigable vessels.
5926 E. J. Preston. Increasing buoyancy of boats.
5940 W. N. Dack & H. B. Barlow. Transferring vessels from one waterway to another.
6022 J. Bickle. Metallic packing for pistons, &c.
6062 W. Buckley. Metallic packings.
6076 A. Gross. Mariners' compasses.
6094 A. D. Bryce-Douglas. Marine boilers.
6097 Lake (H. P. Kirkham). Repairing ships' propellers.
6110 C. Wells & R. R. E. Drake-Brookman. Water-borne vessels.
6132 C. Minto & G. R. Smith. Discharging water from ships' decks.
6134 S. H. James. Sounding apparatus.
6137 T. Woolley. Coating ships' bottoms.
6168 H. C. Simpson. Water wheels and paddle wheels.
6179 J. & T. Linkleter. Deck seats convertible to lifeboats.
6199 R. Brown. Securing covers of ships' hatches.
6252 E. A. Jefferies. Marine and other engines.
6260 J. C. Forrest. Haulage clip.
6271 S. Lloyd. Transferring boats from one level to another.
6329 E. Saner. Producing fresh water from sea water.
6345 W. Burley. Examining hulls of vessels afloat.
6427 J. F. Masterton. Steamboat pier signalling.
6465 J. M. Hale. Propellers.
6473 Thompson (W. T. Sylven). Screw vessels.
6533 W. J. Burkill. Life saving vest.
6543 J. Green. Self-righting boats.
6574 W. H. Daniels. Ships' keels.
6600 E. Paul. Producing fresh water from sea water.
6609 W. Chadburn. Ships' mechanical telegraphs.
6610 Do. Ships' pneumatic telegraphs.
6621 McEuen (N. & H. Selfe). Steam boats.
6641 A. F. A. Manier. Utilising tidal power.
6670 S. & R. & S. H. McKenzie. Anchoring boats or vessels.
6683 J. J. D. Cleminson. Submarine vessels and torpedoes.
6684 W. Hill. Rudder line ends.
6739 Vaughan (S. Trott). Steering apparatus for ships.
6780 J. C. Williamson. Cleaning ships' bottoms.
6785 S. A. Johnson Ships' lamps.
6794 J. C. Stitt. Mechanically propelled boats.
6884 W. B. Barker. Signalling on sea, &c.
6885 Do. Signalling apparatus.
6890 G. W. Fasham & F. W. Pyle. Utilising action of tide.
6918 J. F. Hall & J. Verity. Anchors.
6930 Vaughan (S. Trott). Twin-screw ships.
6998 R. Whitehead. Torpedo engines.
7033 J. B. Hannay. Ships' bottom coatings.
7059 G. Taylor. Shipping and discharging cargoes.
7105 W. C. Cooper. Compasses.
7125 W. E. Winby. Hauling ships, boats, &c.
7146 A. A. Oliva & J. C. Bardili. Preventing capsizing of ships.
7151 J. T. Bucknill & A. J. Day. Laying and raising submarine mines.
7154 J. R. M. Mallett. Propelling boats.
7172 W. R. Renshaw. Surface condensing apparatus for marine engines.
7216 Reed (W. W. Wilcox). Sail grommets.
7217 Do. do. Sail grommets and washers.
7231 O. Kustel. Ships' logs.
7255 W. Y. Fleming & P. Ferguson. Dredgers.
7267 T. B. Jordan. Life saving garment.

Paris Exhibition of 1889.—Messrs. Davey, Paxman & Sons, of Colchester, have contracted to supply the motive power in the British section of the Paris Exhibition of 1889. The contract has been made, with the approval of the committee of the section, direct with the French executive, who undertake to supply motive power gratis to all exhibitors.

BOARD OF TRADE EXAMINATIONS.

Note.—1 C, denotes First Class; 2 C, Second Class.

April 28th, 1888.

Arthur, George . 2C London
Blaikie, W. H... 2C Liverpool
Breckon, G. H. 1C Hull
Buttrum, E. L.. 1C London
Cleugh, Andrew 2C Sunderl'd
Cousens, Geo. F. 1C S'th'pton
Dainton, C. H. 2C Sunderl'd
Davie, Alfred W. 2C ,,
Garrett, T. J. .. 2C Liverpool
Grant, Jas. W.. 2C London
Hall, Wm. H... 2C Liverpool
Henderson, Wm. 1C Sunderl'd
Hughes, John .. 2C Liverpool
Jones, S. G ..... 1C London
Laing, Alex.... 2C ,,
Lynn, Robert .. 2C Sunderl'd
MacGown, J. P. 2C Glasgow
MacKay, Donald 1C London
MacKenzie, John 1C Glasgow
MacKenzie, J. S. 2C Aberdeen
Morrison, T. T. 1C ,,
Nesfield, Thos.. 2C Sunderl'd
Roberts, C. H.. 1C Hull
Robson, Frank.. 2C Sunderl'd
Rowlands, Hugh 2C Liverpool
Scott, John D... 2C Sunderl'd
Shaw, John H. 1C Glasgow
Shannon, A. A.. 1C ,,
Strachan, F. T. 1C London
Urquhart, D. .. 1C ,,
Walliker, J. G. 2C ,,
Warren, Alfred 2C S'th'pton
Williams, R. J. 2C Liverpool
Wilson, Thomas 1C Glasgow

May 5th, 1888.

Arthur, Wm. R. 1C Liverpool
Berriel, Thomas 2C ,,
Blackie, W. H. 2C ,,
Brabban, Jas. .. 2C N. Shields
Buckingham, G. 2C Glasgow
Burns, Wm..... 2C London
Carrothers, Thos. 1C N. Shields
Cunningham, D. 1C ,,
Davies, Daniel.. 2C Cardiff
Dinving, A. .... 1C London
Dixon, John.... 2C N. Shields
Farquharson, G.J 1C Liverpool
Fenton, John .. 2C London
Ferguson, Finlay 1C ,,
Fisher, Donald... 2C Glasgow
Garratt, Thos. J. 2C Liverpool
Hall, Charles .. 1C ,,
Harvey, Thos. W. 2C N. Shields
Hully, Francis C. 2C London
Isaac, Wm. .... 2C Liverpool
Jenkins, John .. 2C N. Shields
Johansson, J. M. 1C London
McKay, John .. 2C Liverpool
Pearson, Matthew 2C N. Shields
Patterson, James 1C London
Perons, James .. 2C Liverpool
Price, John .... 2C Cardiff
Rowand, Geo. .. 2C London
Shirley, Thos. .. 2C Liverpool
Thompson, John 1C ,,
Todd, Hugh.... 1C Dublin
Walker, Chas. A. 2C N. Shields
Whitehill, Jas... 1C Cardiff
Whiting, George 2C London

May 12th, 1888.

Acton, Thos. W. 1C Liverpool
Andrew, Samson 2C London
Arthur, John .. 2C Leith
Bates, Wm. T... 2C London
Curric, Wm..... 1C Leith
Dalby, Thomas . 1C N. Shields
Donald, Jas..... 2C Dundee
Duncan, John .. 2C London
Garden, Jas. H. 1C Leith
Gaskill, Wm. B. 2C Liverpool
Hutchison, Wm. 1C Leith
Meek, Geo. Thos. 2C London
Neilson, Alex... 1C Leith
Oleson, Wm. .. 2C N. Shields
Rice, Matthew.. 1C Leith
Roberts, Wm... 1C ,,
Scott, Robt. M. 2C Liverpool
Spindley, Wm.. 1C Hull
Stevenson, David 2C Liverpool
Walker, H. E... 2C N. Shields

May 19th, 1888.

Barrie, Wm. .. 1C Glasgow
Beckwith, J. A. H. 1C Cardiff
Charley, Alfd. S. 2C Plymouth
Collins, Jas. P. 2C Cardiff
Curry, E. ..... 2C W. H'pool
Dix, Oscar .... 1C ,,
Dixon, Wm. S. 2C Liverpool
Edbrooke, John 2C Cardiff
Ferguson, J. J. 2C Glasgow
Gates, Saml. A. 1C W. H'pool
Glover, Wm. .. 2C Liverpool
Greig, C. McK. 2C Cardiff
Hewitt, Frank J. 1C London
Hodgson, Robert 1C Liverpool
Hutchinson, W. E 2C ,,
Irvine, W..... 2C Dundee
Lemitrins, A. .. 2C Cardiff
McLeod, John .. 1C Glasgow
Metcalfe, Thos.. 1C London
Moon, H. J. P. 2C Liverpool
Morgan, C. E... 2C London
Newton, Wm. A. 2C N. Shields
Philip, Thos. R. 2C London
Proud, John J. 2C N. Shields
Pugh, Henry .. 2C Cardiff
Robertson, G. W. 2C Glasgow
Ricketts, G. H. 1C Cardiff
Robson, T. H. 2C Liverpool
Venables, Edwin 1C ,,
Walsh, Wm..... 2C ,,
Webster, R. J... 2C Glasgow
Williams, A. .. 2C Liverpool
Woodiff, H. D. 1C Cardiff
Wotherspoon, A. 1C Glasgow

Amalgamated Society of Engineers.—This Society met at Cardiff on Monday, May 21st. The President (Mr. T. Davies) referred in his inaugural address to the growth and prosperity of Cardiff. The port, he said, had now seven dry or graving docks, two patent slipways, and an immense floating dock, so that nineteen ordinary sailing vessels or steamers could now be simultaneously repaired. Cardiff had become the first coal port in the world, the exports having advanced last year to 10,940,358 tons.

The Marine Engineer.

LONDON, JULY 1, 1888.

EDITORIAL NOTES.

ONE of the most interesting subjects to shipowners and to shipbuilders is facts concerning the tendency of trade at present as compared with former years, and the consequent probability of better freights and requirements for ships or steamers to maintain the carrying efficiency of the country. In spite of the continued outcry as to general slackness of trade, it is a remarkable fact that there has been a steady increase in the volume of the shipping trade for 1887 even over the year 1885. There was a slight decrease in 1886, which has not only been recovered since, but to a sufficient extent to exceed prior years, the total tonnage cleared during the year 1887 having reached the enormous figures of over 149,500,000. A good portion of this is caused by an increase in foreign trade and also in local trade, though the actual number of vessels engaged in the carrying business has slightly diminished to the amount of nearly 1,600 vessels since 1885. This in itself should mean better profits, and yet the production of new vessels throughout the kingdom for British shipowners keeps at a very handsome figure, though in wooden vessels there is naturally a slight continuous drop, while in steam tonnage there is about a corresponding rise. This shows that the natural march of improvement is still causing the better and more modern steamship to gradually supersede the older and more obsolete wooden vessel; that our general trade as a nation no longer increases by leaps and bounds; that the unnatural inflow of six or seven years ago has met its check, and has apparently touched bottom; and that for the future a steady and normal demand for the production of vessels at between a total of 300,000 to 400,000 tons may be reckoned upon with certainty for the coming years, with a probable steady increase of small amount from year to year. An analysis of total tonnage belonging to British owners in various ports offers some curious and interesting results. Under this heading, Liverpool, London, and Glasgow are very closely tied with one another, Liverpool, however, taking the lead. When, however, it is a question as regards volume of trade from either British or foreign vessels without respect to ownership, London stands materially at the head of the list, with about twice the number of vessels cleared as in any other port, and with about 20 per cent. more tonnage than in the case of the next port, Liverpool. It is, however, remarkable the way in which Cardiff as a clearing port has so rapidly approached to the head of the list, Cardiff under this heading standing third, with nearly two-thirds of the cleared tonnage of that of London, and taking the position above the Tyne, Hull, or Glasgow; and Cardiff still seems to be in the mind not only to retain but improve its position by the steps that have lately been taken to still further develop its shipments of coal and iron ore. Its coasting trade also seems to be increasing almost as rapidly as the foreign trade. By the addition of the coasting trade to the foreign trade, Cardiff does not much alter its relative position to Liverpool and London; but the Tyne ports seem to have the greatest advantage by the inclusion in the computation of tonnage of the local as well as the foreign trade, and thereby takes precedence of Cardiff, their coasting trade being apparently equal to their foreign trade. Taken as a whole, these general figures and results, obtained from the Board of Trade statistics, are very satisfactory, showing that the general idea of decadence of trade is not correct as regards volume of trade, but is merely induced by the great drop in the value of freights, which has so greatly diminished the relative profits of shipowners. This, though unpleasant for the individual interests affected, is a direct boon to the nation at large, as helping the lowering of value of goods as a whole for the consumption of the public, and has now, we believe, by improvements for more economical working, by a slight reduction in the number of ships engaged, and by the steady increase in the volume of trade, reached a point at which the shipbuilders may congratulate themselves as at least earning a good living, though without the enormous profits on capital invested which accrued to them eight or ten years ago, and which were quite abnormal at the time. It is better for everybody, both carriers and producers, that freights and production of vessels should have settled down to a fair remunerative basis, than that by abnormal profits for a limited period there should be so many investors disappointed and even ruined by the sudden collapse of such an abnormal state of things, which is certain to follow.

IT is only comparatively lately that the stability or loss of stability under various circumstances of vessels has become a matter of scientific and precise investigation. No doubt this condition of affairs has arisen very largely or entirely from the fact that whilst the old wooden vessels represented our chief commercial marine and navy, their margin of stability was so great, to give them stiffness

under sail, that it was never an object of any great anxiety, though the foundering of vessels by overturn under sudden squalls is by no means unknown. With the modern construction of steamers however, and our iron-clad navy, the margin of stability at the best is not very good; in the commercial marine too much that was advantageous for sea-going purposes having been sacrificed to plainness of outline, for cheaper building and for maximum cargo carrying; and in the navy a considerable alteration in the centre of gravity by reason of heavy armour and heavy guns in the upper works of the vessel has already put all questions of stability for them on an entirely new footing. In case therefore of actual damage to ironclads, it is still a very open question as to how far the filling of the hold or portion of the hold with water might not entirely disturb and destroy the ordinary stability of the vessel. To prevent such flooding being in excess, it is at present a well known precaution for the hold to be subdivided into many compartments, but the other question still remains as to whether the admission of a certain body of water into one or more compartments of the hold, which might not be capable of causing the vessel to founder, might not disturb the stability of the vessel so much as to render her almost certain to overturn on the slightest disturbance. This problem has, we believe, received little attention hitherto, whilst at the same time we believe it to be quite probable that, with slight alterations in the construction of vessels, the great danger possibly resulting from such flooding might be readily overcome or at least greatly guarded against. The reception of a body of water into the hold of a vessel must necessarily lower the line of flotation of the vessel below its normal point, and must also prove a great danger in the actual position of the centre of gravity with regard to the pressure of buoyancy, by the tendency of fluid to flow over to that side towards which the vessel is heeling. This possible movement of the water within the vessel would be equivalent to the danger of the shifting of cargo when carried in bulk, such as grain, so that the same reasoning and principles of protection would apply equally to both. It is well known that in the case of grain or other bulk cargoes the cargo must be kept from shifting towards that side to which the vessel is heeling, by some contrivance or other, and that it is the upper surface of the cargo that must be particularly controlled in this manner. The same argument would apply essentially to a body of water in the hold of a vessel. It must be prevented from rising to any height in the vessel, as the greater the height, the greater the danger, and the higher the position of the metacentre when the vessel heels. This point should be carefully noted, that a single transverse compartment flooded to the water line or to the inside of an upper deck, is infinitely more dangerous to the vessel than the same quantity of water, even in two or three compartments, where the maximum depth of the water taken in is very limited. As a consequence it is obviously of the greatest importance to hold the water down should it enter through a ship's bottom, or should it enter through a side wound or leak, and that it should be carried to the bottom of the hold and retained there, for which self-acting valves might be designed. Should a certain height of hold be necessary for the general purposes of the vessel, untrammeled by horizontal divisions, then it is of the greatest importance that such point of excessive depth should be limited to a small part of the centre of the hold, leaving shoulder compartments so closed as to prevent access of the water. This it will be seen by a trial would always tend to keep the centre of gravity of such volume of flooded water at a lower point in the hold than if the whole compartment were uniformly filled, and would thus give the line of buoyancy a chance of striking the metacentre above the centre of gravity and thus to maintain stability. We have little doubt that such points of importance will shortly attain due recognition and examination when one or more important vessels have been lost by such accident or injury as we have described.

MANY people are watching with close interest, and with a hearty desire to profit from them, the many experiments that have been going forward for some years in forced draught, or rather, we should say, not so much experiments, but actual runs now being regularly made with vessels under forced draught. We are afraid that they, like ourselves, find it very difficult to ascertain reliable information as to the absolute results obtained during an average sea run with forced draught *versus* natural draught. Forced draught in itself is not new, as on many occasions, particularly in blockade runners, forced draught has been used for special emergencies, and there is no doubt in anybody's mind that forced draught will enable a given steamship to obtain an excessive and abnormal rate of steaming. But this is not the question of particular interest to shipowners generally, since in urgent cases the excessive evaporation has to be obtained at all cost, and would therefore prove of little value for general use in a long run. The navy also, of which a great number of vessels are fitted with forced draught, will tell us nothing that a shipowner wants to know on the

head of economy. It is not a question to the shipowner as to how well the speed of a ship may be forced for a period of six or eight hours or longer, but whether such a system applied to general use in the commercial marine would be of ultimate advantage to the boilers and engines of the vessel, or result in loss of economy for any given speed developed by this system. We are well aware that there are enthusiastic advocates for the adoption of this system to steamers in the commercial marine on the ground of higher speeds and better economy of fuel when the heated blast is connected with the forced draught, but though such apparatus has been more or less in operation for the last three or four years, there is a somewhat significant absence of any proof in support of these views. In fact, from rumours one catches here and there as to the results of forced draught when used, the information obtained is that it proves considerably hurtful to the furnaces and boilers in which it is employed and is regarded somewhat as a necessary evil to be used when absolutely required for safety, but otherwise to be used as seldom as possible. We should suggest to those interested in pressing the importance of this subject upon the commercial marine that shipowners do not care one pin's head as to the various difference in detail in some of the systems at present applied, and over which there is often so much wrangling; but that what they really do want to know is whether it is to their advantage at all to think about adopting such a system to any vessel, the basis of whose running is to be the commercial basis of economy. Plenty of paper and time may be employed in arguing the question backwards and forwards on theoretical data, but this is a very weak way to attempt to carry conviction to any man's mind which has a practical commercial bias; and as it is now generally realised that passenger vessels or liners may be built to order to run almost any desired speed, provided the money is forthcoming to the builder, and the speed is worth the extra money in fuel that would certainly be consumed to produce that speed, forced blast will have a poor time of it with the practical shipowners unless some more definite and satisfactory results are made public for their information.

In the majority of commercial industries the extreme pressure of severe competition, coupled with the existing high rates demanded by our railways for the carriage of goods, has been most acutely felt of late years, and, as a consequence, schemes as plentiful as butterflies in June have, from time to time, been concocted for the improvement of existing canals, and the construction of new ones, whereby, to some extent, a reduction in the transit of goods might be effected. It is strange to relate, however, that while many of these projects have perished almost simultaneously with their appearance in print, and others have more or less slowly followed suit, the greatest artificial waterway ever attempted in this country—the Manchester Ship Canal—is the only scheme that has weathered the storm of adverse criticism and strenuous opposition, and is practically being carried out. It is not necessary here to elaborate upon the unquestionably difficult problem as to whether this gigantic undertaking, when completed, will or will not ultimately conduce to the lasting benefit of Manchester, and to the detriment of Liverpool commerce. Time alone must, after all said and done, decide what is at present a matter of pure conjecture. In the meantime it is alike instructive and interesting to watch the march of events. At the time of writing, holders of shares in the Canal find themselves about 10 per cent. richer than they were a week or two ago, while confidence is gradually being established among a certain section of the investing public respecting the speculative project. This is owing to a large extent to the satisfactory progress now being made in Parliament with the "Manchester Ship Canal (No. 2) Bill," and which will doubtless be read for the proverbial "third time" before our next issue. Since the passing of the original Act of the Company, Sir Humphrey de Trafford, who entertained strong objections to the construction of works upon that part of his property known as the Home Farm, has departed this life, and his successor has recently disposed of a large portion of the property in question to the Company. The prompt acquisition of this will enable the directors to make additional alterations and improvements in the course of the Manchester and Salford end of the canal without interfering with the work already accomplished. The only access to the proposed Manchester Docks in the original plan was through the Salford Docks, but the passing of "Bill No. 2" will give an independent passage to the first-named, in addition to a larger wharfage accommodation at both docks. To minutely describe the rapid advancement made in this huge undertaking from month to month would at least occupy the space devoted to the now fashionable three-volume novel. Fresh fields and pastures new are rapidly giving place to fragmentary bits of cutting in some places and embankments in others; engines and endless rows of trucks hurry over miles of parallel rails; contractors' offices, yards, and workshops abound in all directions; and all night long, as well as day in many of the sections, there

is one continual uproar arising from the hammering, forging, steaming, digging, and building. The innumerable and roughly-hewn wooden huts of the sons of toil are strongly suggestive of bush life in the backwoods of America; and altogether the panoramic picture presented by this enormous and busy hive of industry may be better imagined than described. The construction of the thirty-five mile channel has been divided by the contractor into longitudinal sections of three to four miles apiece. In all, there are nine such divisions, and the work has progressed with such celerity that at some points the several sectional systems will soon communicate with one another. The Eccles and Barton portions have especially undergone a change during the month, where upwards of 1,000 men are now employed. Three steam navvies—two American and one French—are at work on the cutting between Lane End, Eccles, and Sticken's Island, Salt Eye, Barton.

It may be in the recollection of our readers that the original scheme for the canal was to enable the tide to flow from the estuary at Eastham to Manchester, but ultimately this idea was abandoned for a semi-tidal stream with locks, by which vessels will be raised bodily on their passage from the estuary to the level of the quays. Locks at Runcorn, Latchford (near Warrington), Irlam, and Barton, will effect a rise of 60 ft. 6 in. above the level in the entrance locks at Eastham. In addition to the water supply contributed from the Mersey, the Irwell, and minor streams, there will be water available from the Thirlmere pipes now laying to Manchester. It was also anticipated that the springs which the canal would lay bare would materially help to keep up a sufficient depth of water when the work was completed. These anticipations have been happily verified recently, and the hearts of the shareholders have rejoiced accordingly. Water is constantly oozing enough already through the banks and bed of the canal to keep steam pumps fully employed. We intend to report progress respecting this gigantic piece of engineering from time to time until its completion, which is announced to be in working order by January 1, 1892. M. de Lesseps was ridiculed as a dreamer or an impostor not only at the outset of the Suez Canal scheme, but until the last spadeful of dirt was cast upon the banks. Subsequent events have amply proved that the scoffers were wrong. Not only has the canal been of an immense convenience to our trade with Eastern nations, but a stern necessity. The original shareholders who stood by M. de Lesseps at that most critical and trying period, have been justly rewarded since by their shares having nearly trebled in value. It is, therefore, possible that what is now considered by the great seaport of the north as an approaching stumbling-block to their prosperity may eventually turn out a blessing in disguise. We sincerely hope so, and further trust that history may repeat itself in this case, although the secret of success or failure of the Manchester Ship Canal remains at present as hidden as the philosopher's stone.

SLIDE VALVE GEARS.*

By Mr. J. T. MILTON, M.I.N.A.

THE problem of how to impart a suitable motion to the distribution valves of steam engines is one which has met with several solutions, various descriptions of gear having been proposed for the purpose. In this paper it is intended to notice a few points of interest in connection with some of those which are used at the present time, it being impossible to treat exhaustively upon the merits or demerits of any one gear within the limits of a paper, and it will be principally to the *motion* produced that attention will be directed.

The requirements of a valve gear for marine engines include not only the necessity of giving such a distribution of steam as will enable the engine to work economically when in full-ahead gear, but also such as will ensure the engines readily starting from any position both ahead and astern; and, further, it must be capable of giving a satisfactory result when the engines are "linked up" and working at less than full power; the latter consideration in war vessels being very important, as most of their cruising is done with the engines developing considerably less than their maximum power.

For illustrating the motion of the valve produced by any gear, the method used will be that known as Zeuner's. Several valve gears are illustrated by this method in Zeuner's treatise on valve gears, and particular reference to some of them will be made in the course of this paper.

In this method of representing motion, polar co-ordinates are used, the distance the valve has travelled from the centre of its motion for any particular angular position of the crank shaft being represented by the distance measured along the crank, or along a corresponding radius, when in that position. For illustration, let the case of a slide valve actuated by a single eccentric be taken.

In Fig. 1, let C be the centre of the crank shaft, and A B a line passing through the centre in the direction of motion of the slide valve. Let A P B be the circle described by the centre of the eccentric, then the total travel of the slide valve will be equal to A B. Also if P be any given position of the centre of the eccentric, then, neglecting the obliquity of the eccentric rod, if P D be drawn perpendicular to A B the position of the valve from the end of its stroke will be represented by the distance A D, while D C will be its distance from the centre of its travel. If now along C P a length C E be set off equal to C D, it will be found that the point E will always lie upon a circle having A C as a diameter, or upon the equal circle having B C as a diameter. (By joining A E it will at once be seen that A E C and P D C are equal and similar right-angled triangles, and since the angle in a semicircle is a right angle, E will always fall on the circumference of the circle.)

If, therefore, in any case A B be drawn parallel to the direction of the motion of the valve, and C A, C B be each made equal to the eccentricity of the eccentric, or half the travel of the valves and upon C A and C B as diameters there be described the circle, A E C, B F C, then for any position of the centre of the eccentric, represented by P′, if C P′ be joined, the distance C E′ will represent the corresponding distance of the valve from the centre of its travel, and the valve will be above or below its central position, according as the line C P′ cuts the upper or lower of the two circles. These circles are called Zeuner's valve circles.

These circles, drawn as in Fig. 1, represent the motion of the valve by the distance along the radius representing the *position of the centre of the eccentric*, but in general we do not so much require

* *Read at the North East Coast Institution of Engineers and Shipbuilders. Theodore Doxford, Esq., President, in the Chair.*

FIG. 1.

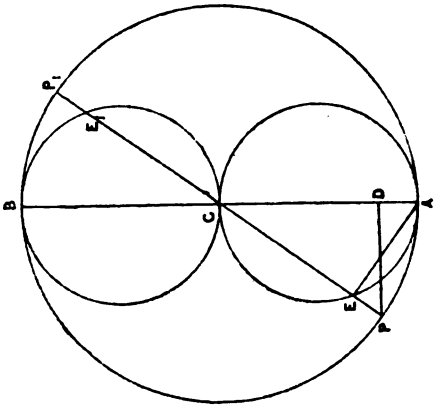


FIG. 2.

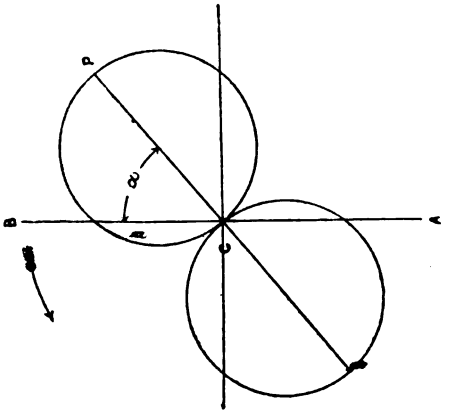


FIG. 3.

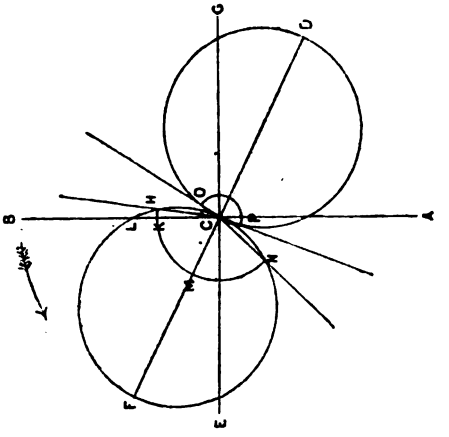


FIG. 4.

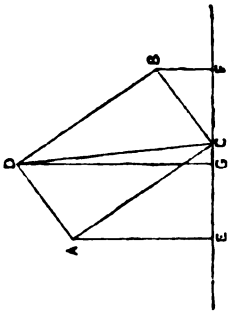


FIG. 5.

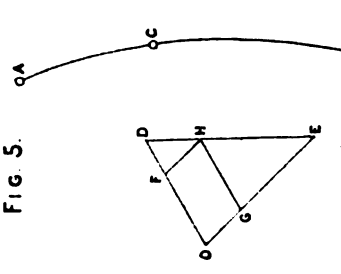


FIG. 6.

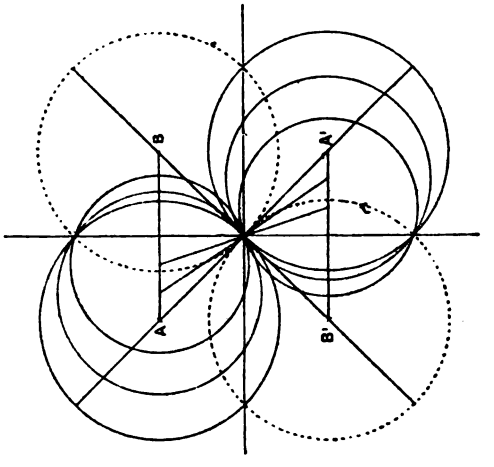


FIG. 7.

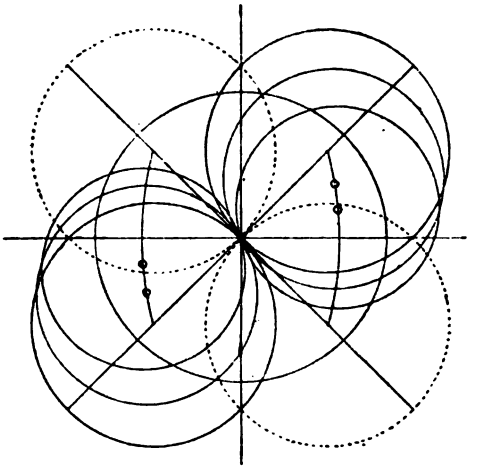
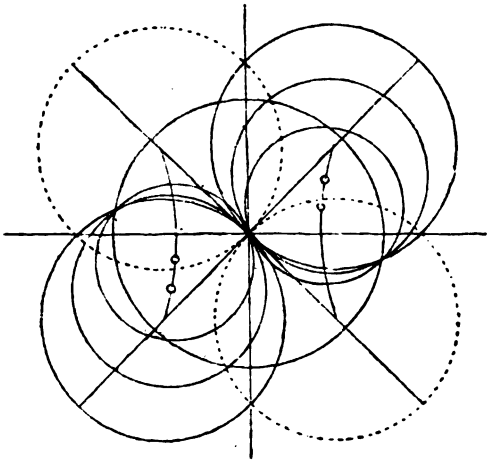


FIG. 8.



to know the motion of the valve corresponding to the position of the *eccentric* as we do its motion corresponding to a given position of the *crank*.

Let the eccentric be at any given angle α in advance of the crank: in Fig. 2, if A B be the line of centres, and if the angle B C P = α, C P will be the position of the crank when the eccentric is on the top centre and the slide valve at the upper

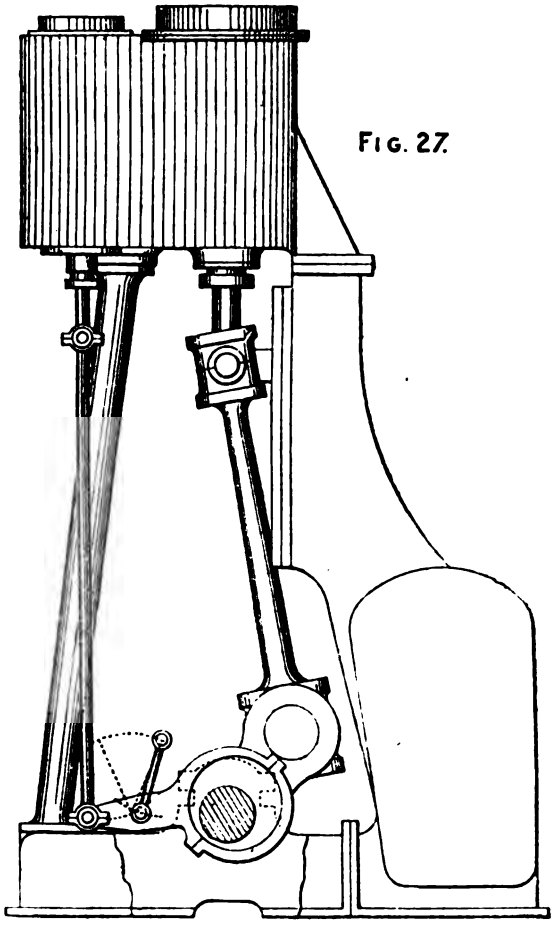


FIG. 27.

extremity of its motion. Hence, if C P be made equal to the eccentricity, and on C P and C P produced the valve circles be drawn as before, these circles will represent the positions of the valve corresponding to the positions of the crank represented by the radii. If the angular positions of the crank and eccentric are coincident the angle α is zero, and the circles become, as in Fig. 1, the upper circle representing the position of the valve during the upper half of its motion, while the lower circle represents it during the lower half. If, however, the angular position of the eccentric is opposite to that of the crank α = 180°, and Fig. 1 still represents the valve motion, but with the difference that the *upper* valve circle represents the distance of the valve *below* its central position, and the *lower* valve circle represents its distance above that position.

In the ordinary case where the eccentric is placed at some angle between 90° and 180° in advance of the crank, the diagram becomes the ordinary well-known valve diagram shown in fig. 3, where B C D is the angle by which the eccentric precedes the crank, and where, accordingly, F C E, D C G are each what is ordinarily called the angle of advance. In this diagram the upper circle represents distances of the slide *below* its central position, and the lower circle corresponding distances *above* its central position.

To use this diagram the circles H K N and O P are drawn with radii equal to the outside lap and the inside lap respectively of the upper end of the valve. Then for the upper side of the piston C H will be the position of the crank at which the valve first opens to steam, K L will be *lead*, F M the maximum port opening, C N the position of the crank at the point of cut off, C P its position when the release commences, and C O its position when the exhaust port closes. Similar constructions will give like data for the lower side of the piston.

Instead of supposing the valve to be acted upon by one eccentric only, suppose its motion to be such as would be imparted by two eccentrics acting simultaneously; such a motion for instance as would result from some mechanism which if acting alone would give a motion identical with that produced by one eccentric, while the whole mechanism receives an independent motion similar to that derivable from another eccentric (Kirk's and Bryce-Douglas' valve gears shown in figs. 21 and 22, represent cases of this description); it will be seen that the resulting motion of the valve will be exactly the same as that which would be produced by a third eccentric having a particular position and eccentricity depending upon the angular positions and the eccentricities of the two first eccentrics.

For example, let the motion be such as would be derived from that of an eccentric having its centre at A superimposed upon the motion derived from an eccentric with its centre at B. (See fig. 4.) Then if A E and B F be drawn perpendicular to the line of centres, the position of the valve, so far as it is influenced by the eccentric A, will be at a distance C E to the left of the centre of its travel; and so far as it is influenced by B, it will be a distance C F to the right of the same centre. If E G be set off equal to C F, it will be seen that G will represent the actual position of the valve. If, now, A D and B D be drawn parallel to C B, C A, meeting in D, it is evident that G is the position which would be derived from an eccentric having its centre at D. This holds true for every position of the eccentrics during the whole revolution of the shaft.

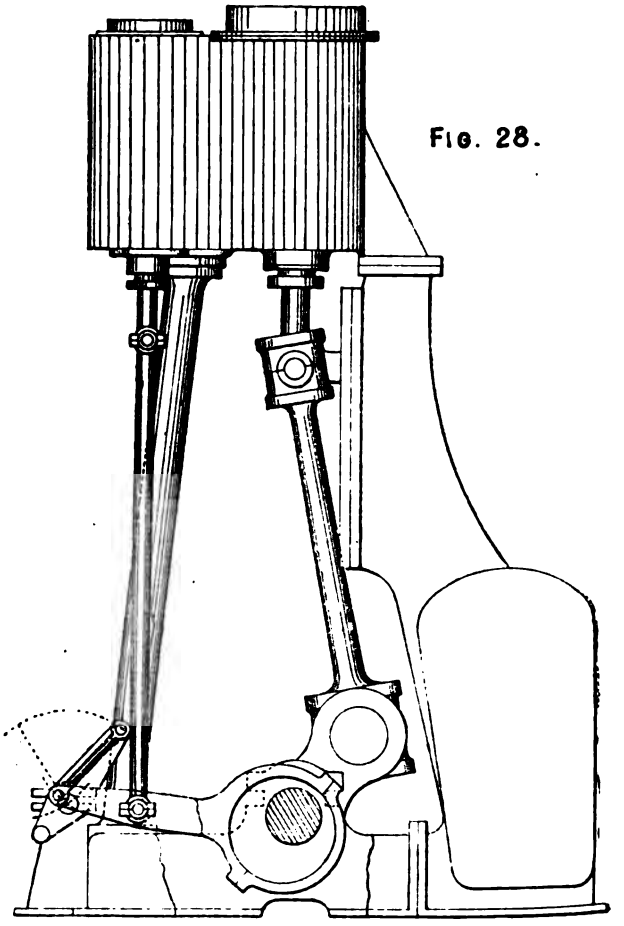


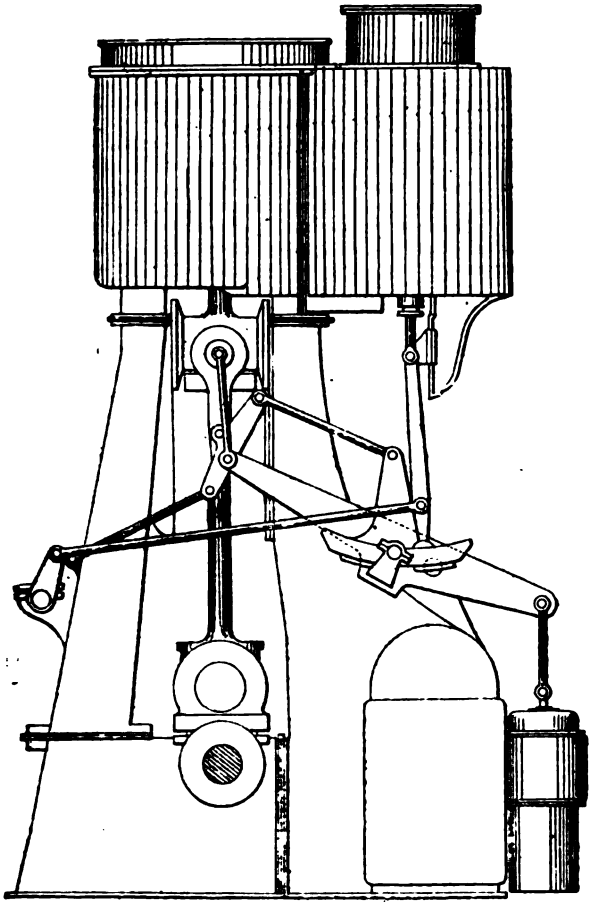
FIG. 28.

(This proposition is proved mathematically by means of polar co-ordinates in Zeuner's treatise when discussing the motion of Meyer's expansion valve.)

To illustrate Mr. J. T. Milton's paper on "Slide Valve Gears."

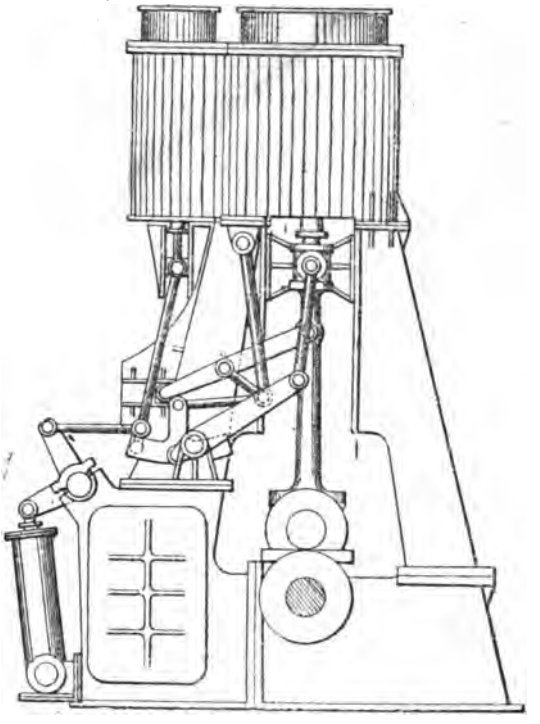
KIRK'S GEAR.

FIG 21



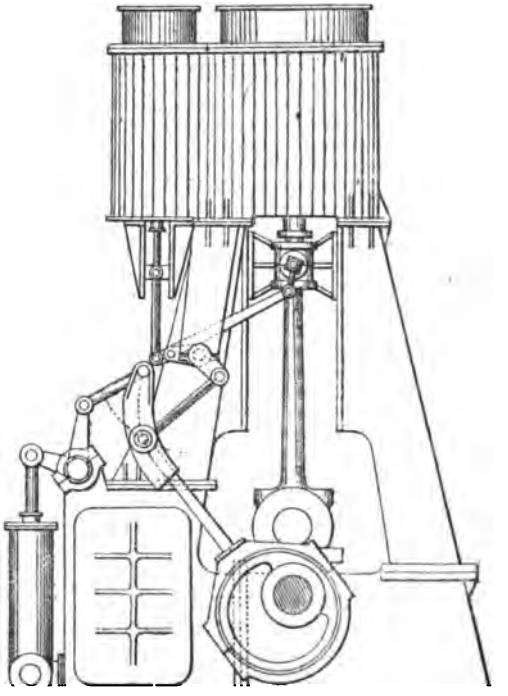
BRYCE DOUGLAS' GEAR.

FIG 23



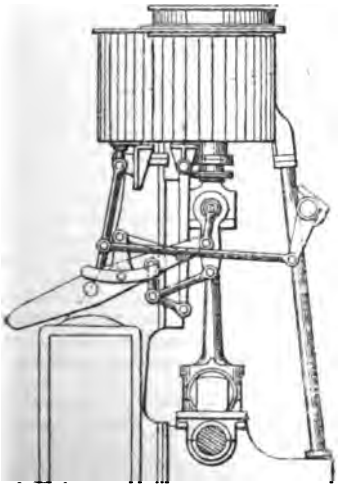
BRYCE DOUGLAS' GEAR.

FIG. 24.



BRYCE DOUGLAS' GEAR.

FIG. 22



It is thus seen that, neglecting the obliquity of the eccentric rods, if a valve is actuated by the combination of two motions, each of which, if it acted alone, would be such as could be produced by an eccentric, the resultant motion will be exactly the same as that which would be produced by a third eccentric having a position and eccentricity determined by the construction described. This is very important, and does not appear to be so fully recognised as it deserves to be, as the opinion is often expressed that the motion produced by the combination of two right-angled movements causes the valve to move more quickly when opening and closing the steam ports, and to move less rapidly when at the extremities of its motion than would be the case if the valves were moved by one circular motion only.

With most valve gears in general use it will be found that, except so far as concerns small differences in the motion produced by the obliquities of the rods, or in some cases by substituting slightly curved for straight paths for some parts of the gears, the motion produced is essentially such as might be produced by a single eccentric suitably placed. To show this, diagrams will first be drawn representing the motion which would be produced if the obliquities, &c., were neglected, and then other diagrams will be given representing the actual motion produced by the gears as used in practice.

Take the case of the ordinary Stephenson link motion. When the link is in full gear and the end of the valve rod is brought fair with the end of one eccentric rod, the motion of the valve is of course exactly the same as would be produced by that eccentric alone, the motion of the other eccentric not producing any effect on the valve; but when the link is put over in some intermediate position each rod produces an effect upon the valve's motion.

For example, in fig. 5 let A B be the link, and suppose the slide to be worked from a point C, intermediate to A and B, then the motion of C will be produced by the action of both eccentrics, and will be similar to the motion of B, reduced in the proportion of $\frac{A C}{A B}$, superimposed upon the motion of A reduced in the proportion of $\frac{B C}{A B}$.

If O be the centre of the shaft and D be the centre of one eccentric and E that of the other, then if O D and O E be joined and O F be made equal to $O D \times \frac{B C}{A B}$, and $O G = O E \times \frac{A C}{A B}$ the part of the motion of C obtained from A will be such as would be produced by an eccentric having its centre at F; while that part of the motion which is obtained from B will be such as would be derived from an eccentric having its centre at G. Hence, if F H be drawn parallel and equal to O G, it follows that the actual motion of C will be that which might be obtained direct by an eccentric having its centre situated at H.

It is evident that H falls on D E, and that it divides D E so that $\frac{D H}{H E} = \frac{A C}{C B}$.

It is thus seen that, neglecting for the moment the obliquities of the rods, if in Fig. 6 A and A^1 are the centres of the valve circles representing the motion produced by the go-ahead eccentric, and B and B^1 the centres of the valve circles representing the go-astern motion, then, if A B, $A^1 B^1$ be joined, the motion of the valve produced by intermediate positions of the link, when working "linked up," will be represented by valve circles having their centres falling upon A B and $A^1 B^1$ and dividing them in the proportion which the working point divides the length of the link. Also, when in mid-gear the motion would be the same as that produced by an eccentric situated diametrically opposite that of the crank.

When the effect of the obliquities of the eccentric rods is taken into acconnt, the motion of the valve when "linked up" is still identical with that which would be produced by a particular eccentric, the centre of which, however, lies near but not upon the straight line joining the centres of the two actual eccentrics. The mathematical proof of this is given in Zeuner's treatise, and from the results there deduced, Figs. 7 and 8 are drawn, the differences between these figures and Fig. 6 showing the effect produced by the obliquities of the eccentric rods. Fig. 7 represents the case of *open* and Fig. 8 that of *crossed* rods.

(To be concluded in our next number.)

The Natal Harbour Board have placed with Messrs. W. Symons & Co., Renfrew, an order for one of their powerful hopper dredgers. It will be specially designed to meet the requirements of the port of Durban. The bucket ladder will be adapted to work through an opening at the stern, and the builders' patent traversing gear is to be fitted.

FIRE RISKS IN SHIPS FROM THE ELECTRIC LIGHT.

WHILE much has been said and written upon the safety and advantages of the use of the electric light compared with other artificial illuminants, and also as to how, in many cases, it has been installed, the dangers of fire from the light, and those which have occurred therefrom, and particularly in ships, do not appear to have been pointed out as they should have been. But little also has been mentioned as to the more efficient means whereby the electric light should be installed in ships, and the ill results of a multiplicity of regulations by different authorities for this purpose. On these points we will now offer a few observations, in the hope that the subject will receive more attention from the shipping community than it has done.

With regard to the risks of fire from the electric light, it is properly said by Mr. Musgrave Heaphy, C.E., Consulting Electrician to the Phœnix Fire Office, that "where systematic and proper precautions are taken there is less danger from electric lighting than gas, but that if carelessly or ignorantly arranged or improperly worked, then serious fires may be apprehended." This assertion is greatly corroborated by the verdict of the jury at the inquest upon the loss of life by the destruction of the Philadelphia Theatre early in May by the electric light, and the cases of fires which have occurred in buildings from bad installations of this illuminant; and these remarks will apply to the electric light in ships.

The theatre referred to was lighted by incandescent lamps of the Edison Company's system, and the verdict as to the origin of the fire included the following conclusion, viz.: "We find that there was no evidence of other cause of fire save electricity; that the fire was not due to incendiarism; that without proper workmanship, care, and conditions it is possible to cause fire by means of incandescent light currents of low potentiality in many ways." To their verdict the jury appended an expression of its obligations to Inspector McDevitt, of the fire insurance patrol, and for his skilful experiments, which conclusively proved—"*First:* That incandescent lamps will set fire to inflammable substances when the heat in them is confined and allowed to accumulate, and that the lamps need not break in order to do this. *Second:* That the breaking of an incandescent lamp will set fire to inflammable gases. *Third:* That water or moistened wood will short-circuit incandescent circuits and cause fire in so doing. *Fourth:* That loose joints unsoldered are dangerous and liable to cause fire. *Fifth:* That the wearing away of insulation on flexible leaders will cause fires unless safety plugs are used. *Sixth:* That a careful system of safety plugs for all parts of a circuit, thorough insulation for all parts of a circuit, soldered joints, and care not to place lamps so that heat can accumulate are first requisites in a safe system of incandescent lighting. . . . While we think it our duty to state the possible causes of fire by means of electric light circuits, we believe the risk to be controllable and a minimum in case of workmanship by reliable companies."

With regard to the fires in ships which have resulted from the electric light, most of them have been carefully concealed, but it is known that some noteworthy cases have occurred. An American cargo steamer was totally destroyed and eleven lives lost on one of the United States coasts by the firing of cotton from the electric light. The saloon of one of the leading British mail steamers trading between Liverpool and New York also caught fire from the new illuminant. A fire also took place on board one of our men-of-war from such light. Mr. Preece, F.R.S., in a paper read by him on the 11th of last month on "Fire Risks of the Electric Light," before the Society of Telegraphic Engineers and Electricians, stated that three or four instances had happened where the wood had taken fire from the electric light on board ships. The number of recorded instances in which buildings have been fired and destroyed by the electric light is very great, and cannot fail to convince those to whom the installation of the light in ships is entrusted of the great risks of fire in ships unless the installation of such is made under excellent precautions. Various rules, more or less meritable, have been drawn up for fire insurance offices for the installation of the electric light in buildings, the best of which appear to be those of Mr. Heaphy for the Phœnix Fire Office, and known as the "Phœnix Rules." These have been eminently successful, and no fire has happened from the electric light in any buildings in which the installation of the illuminant has been made according to such regulations.

Further precautions are, however, said to be essential than those contained in these rules for fixing electric light plant in

ships, and in the system originated by Mr. Charles Hall, A.M.Inst.C.E., M.I.N.A., M.S.T.E., Consulting Electrician, &c., &c., to the P. and O. Company, these precautions are adopted by requiring safety fuses to every lamp, and the exclusion of transformers and other means. In the new steamer *Victoria*, of this company, Mr. Hall initiated the system of reducing the high running speed of the dynamo down to the ordinary type of engine driven at about 200 revolutions per minute, similar to those made by Tangye Bros. Although this method was at first much opposed, a great number of steamers have been installed by it, and no fire or breakdown of the electric light plant has taken place in any ship to which it has been applied. Beyond other advantages it prevents scamped work, as the least fault is at once manifest. Under the old system it was a common practice to vamp up a cheap installation, much to the risk of fire therefrom, and which defect could only be ascertained by an expert. The workmanship in connection with such was also so bad that the installation required material if not entire renewal within two years or thereabouts.

The necessity of proper rules for the installation of the electric light is so great that it cannot be too often impressed upon the notice of all users of the light. Mr. Preece, in his paper referred to, well said on this head that "Electricity is a field for ignorance, and it is above all things one in which what our American friends call Cheap Jackism is rampant. The result is that rules and regulations are absolutely essential to protect the users of electricity from the rapacity of those who supply it" It should be borne in mind, however, that a multiplicity of rules for the installation of the electric light in ships will occasion the utmost confusion and increase the danger of this illuminant therein, as unscrupulous contractors will take undue advantage of so many rival rules, and so do cheap and bad work. It is to the interests of the shipping community that proper precautions should be adopted to have their steamers efficiently installed with the electric light, otherwise it may, in the near future, be a question with underwriters whether they will not increase the rate of premium for the insurance of ships not installed with the light under the system which experience has proved to be the safest.

HER MAJESTY'S SHIP "VICTORIA."

ON June 14th the powerful turret ship *Victoria*, so named in honour of Her Majesty's jubilee, completed her steam trials at the Nore. The first rivet was driven in her keel plate by Lord Armstrong at Elswick in June 1885, and she was launched on the 9th of April last year. In respect to the essentials of speed, protection, and armament, the *Victoria* is without a competitor in the navies of Europe. In design she may be said to resemble a magnified *Hero;* and though exception has been taken to the curtailment of her armour belt which extends for 162 ft. over her total length of 340 ft., and to the alleged dangerous concentration of her heaviest guns in a single turret, it must not be forgotten that naval construction is only possible on the principle of compromise, and that it is more satisfactory to judge of the efficiency of a battle-ship by the balance of advantages she gains by sacrificing something in her design. Comparing the *Victoria* with the crack French armourclad *Amiral Baudin*, we find that the latter possesses a complete belt at the water-line of the uniform thickness of 21½ in., while the English ship is only partially protected by a belt varying in thickness from 16 in. to 18 in.; and that, whereas the Frenchman carries three heavy guns in as many barbettes, the English vessel has her 110-ton guns boxed up in a single turret. But, on the other hand, while the redoubt and turret of the *Victoria* is built up of armour 18 in. thick, the barbettes of the *Amiral Baudin* are of the thickness of 16½ in. The former is also more powerfully armed and engined, has a wider area of action, and is superior in speed in the ratio of 17 knots to 15 knots under forced draught. And all these advantages she carries into action upon, in round numbers, a thousand tons less displacement, besides being protected against raking by a bulkhead 16 in. thick, and an angular screen of 6-in plating. Had it been determined to continue the *Victoria's* belt throughout the sides upon the same displacement, it would have been necessary to reduce the armour from a uniform thickness of 18 in. to 14 in. and 12 in., or, on the other hand, had the belt been continued to the ends without thinning it in the middle and making it 12 in. at the extremities, the displacement of the ship must have increased to 11,000 tons. As she now exists, the estimated loss of buoyancy by the complete riddling of the unarmoured ends amounts to 41 tons, representing a total sinkage of 2 in.

Her armament will consist of two 110-ton breechloaders, which discharge projectiles of 1,800 lb. with *maximum* charges of 900 lb., each gun being capable of firing ahead and also, in consequence of the conformation of the superstructure, on the side within an arc of 150 deg.; one 30-ton gun firing astern and on either quarter; twelve 5-ton guns, twelve 6-pounder, and nine 3-pounder quick-firing guns, besides machine guns for smaller ammunition. In other words, the *Victoria* will be able to discharge from the broadside 4,750 lb. of metal simultaneously, consuming 3,000 lb. of powder. She is also fitted with eight torpedo dischargers. This stupendous fighting machine will have a complement of 550 officers and men, of whom 110 will be engineers, stokers, and other non-combatants. According to the Navy Estimates for the current year, the total cost of the *Victoria*, including hull, machinery, and guns, is £817,841.

The *Victoria* has been supplied with twin-screw triple-expansion engines by Messrs. Humphrys, Tennant & Co., of Deptford. The cylinders are 43 in., 62 in., and 96 in. in diameter respectively, with a stroke of 4 ft. 3 in. The contract power is 12,000 H.P., with forced draught and enclosed stokeholds, and 7,500 H.P. with open stokeholds. They are by far the largest triple expansion engines yet supplied to the Navy, and are practically identical in design with the engines of the same power which are now being fitted by Messrs. Humphrys and Tennant to Her Majesty's ship *Sans Pareil*, sister ship to the *Victoria*, built by the Thames Iron Works, Blackwall. The general arrangement of the machinery is very similar to the firm's well-known three-cylinder engines in the Navy. The cylinders are carried by polished steel columns, the air-pumps being actuated direct off the low-pressure pistons, the crank-shafts working in steel frames bolted on to box girders which form part of the structure of the vessel. The condensers, which are made of gun-metal, are placed at the side of the main framing, and contain 14,000 ft. of cooling surface. An auxiliary condenser is fitted in each engine-room for the purpose of condensing the waste steam from all the small engines throughout the ship, of which there are a vast number. Steam is supplied at a working pressure of 135 lb. by eight four-furnace boilers, constructed entirely of steel, and disposed in four separate and independent stokeholds. The forced draught arrangements resemble those fitted by Messrs. Humphrys to the armour ships of the *Admiral* type, the fans being driven by Brotherhood's small three-cylinder engines.

The trial with open stokeholds, or, as it is sometimes, but erroneously, termed, under natural draught, came off on June 12th under the superintendence of Captain Stevenson, C.B., the head of the Medway Steam Reserve. Captain Symons, of Her Majesty's ship *Pembroke*, was in charge of the navigation of the ship; and among those in attendance were Mr. R. J. Butler, who represented the Admiralty; Messrs. P. Watts, R. Black, and M. Sandison, from the Elswick firm, the builders; Mr. J. H. Ferguson, chief inspector of machinery of the Medway Reserve; Mr. Michell, fleet engineer of the ship; and Messrs. Andrews and Crocker, who represented the engineering and constructive departments of Chatham Dockyard. Mr. Robert Humphrys conducted the trials on behalf of the contractors. The *Victoria* was run for four hours, but without unduly pressing the engines, as the contractors were confident of exceeding the guaranteed power under the conditions. At the end of the trial the following mean results were worked out:—Steam pressure in boilers, 131·16 lb.; vacuum, 27·8 and 26·8 in.; revolutions, 87·3 and 88·5 by the starboard and port engines; I.H.P., 3,855 9 starboard and 4,182·1 port, giving a collective I.H.P. of 8,038·04, or 538 horses in excess of the contract. The mean speed realized, as measured by patent log, was 16 knots.

The comparative ease with which these *data* were obtained, and the freedom during the run from any symptons of priming or heating, augured well for the success of the trial under forced draught, upon the results of which would depend the value of the ship as a fighting machine in moments of exceptional emergency. This took place on June 14th, the ship on the occasion being in command of Captain Ferris, Mr. Bedbrook representing Chatham Dockyard, the other officers in attendance being the same as on the previous trial. The ship was brought down to her loadline by water and ballast—namely, 26 ft. 3 in. forward, and 27 ft. 3 in. aft, so that her performances on the trial may be considered as closely approximating those which she would be capable of fulfilling on actual service. The *Victoria* got under way from the anchorage at the Nore at half-past 9, and shortly after noon, steam having been worked up to the desired pressure and the fans pumping air into the stokeholds at about 450 revolutions a minute (representing a water pressure of 1·97 in.) the official observations were begun. The result of the first half-hour showed that the engines had

developed the extraordinary power of over 14,500 horses, and, as there was no lack of steam, this high average was maintained with little variation throughout the four hours' steaming, which were completed without any hitch of any kind occurring from first to last. The total absence of vibration when the engines were developing their utmost energy also satisfactorily showed that the structure of the ship and the connections of the machinery to the hull were of the most stable character. The following are the hourly returns obtained during the run:—

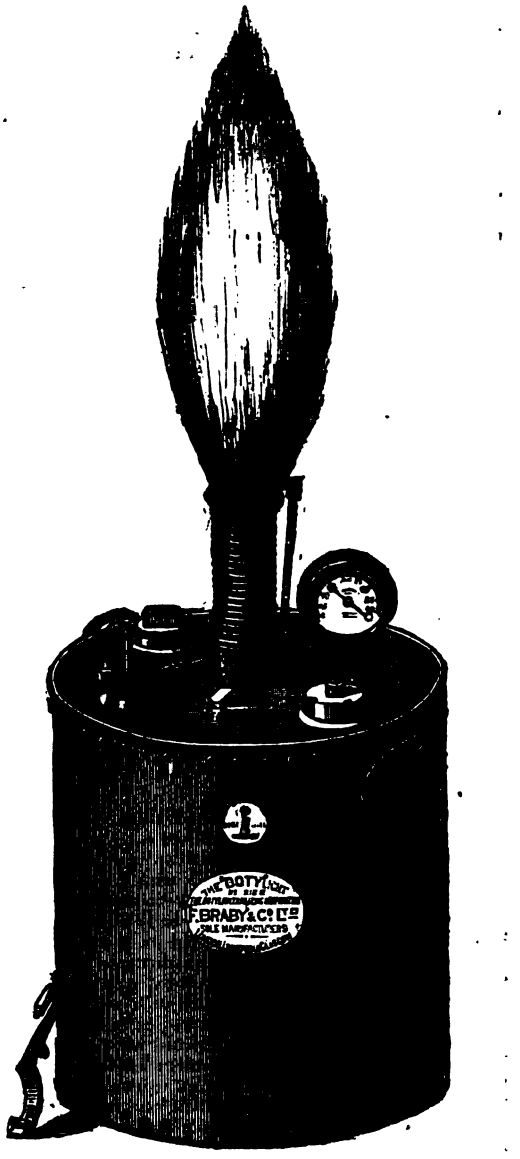
Revolutions.		Indicated Horse Power.		Collective Power.
Starboard.	Port.	Starboard.	Port.	
102·4	101·2	7,344·16	7,231·71	14,575·87
100·8	100·4	7,078·27	7,054·01	14,132·28
101·3	100·0	6,969·24	7,157·12	14,126·36
100·7	100·1	7,039·03	7,104 62	14,143·65

The means of the observations taken during the four hours' steaming gave the following results:—Steam pressure in boilers, 133·4 lb.; mean air pressure in stokeholds, 1·97 in. of water; vacuum in condensers, starboard 27·4 in. and port 27 in.: mean revolutions, 101·26 starboard, and 100·37 port; mean I.H.P., starboard 7,107·67 and (port) 7,136·86, giving the remarkable collective I.P. of 14,244·54, being no less than 2,244.54 horses above the 12,000 guaranteed, great as that was. The speed of the ship was over 17½ knots, the entire series of results being obtained at an expenditure of 2 lb. of coal for every I.H.P. an hour.

At the conclusion of the trial the officers expressed great satisfaction at the unique results obtained. The *Victoria* returned to Chatham to complete for sea.

THE DOTY LAMP.

PROFESSOR CARLTON J, LAMBERT, of the Royal Naval College, Greenwich, an expert in artificial lighting, has subjected the Doty lamp to exhaustive tests and written a report. His photometric tests give an illuminating power of 674 candles, with an hourly consumption of nine-tenths of a gallon of sixpence-halfpenny per gallon American petroleum or paraffin oil. After his laboratory tests the professor made such open-air trials as would arise in loading or unloading cargo, in dredging, excavating, tunnelling, repairing permanent way, lighting workshops and factories. He found the results satisfactory. He found the lamp adapted to the illumination of large areas at night, and the flame practically unaffected by a moderately strong wind. The fact is that American petroleum or paraffin oil, in the condition of vapour and in the massive flame form of the Doty lamp, is inextinguishable. Professor Lambert says:—"I find that the apparatus can easily be carried about by two men even when the light is burning; that after the lighting up, which occupies five minutes, no attention is required for four or five hours; that a few strokes of the air condenser will give a new four or five hours' spell of lighting, and so on, as long as a drop remains of the seventeen gallons which the lamp holds; that the light is brilliant as well as economical; and that there is immunity from danger." Such, strung together, are the professor's practical and scientific qualities of the Doty lamp. The workmanship, down to the smallest mechanical detail, is such as would be expected from a firm with a reputation to maintain. Messrs. F. Braby & Co., Limited, of London, Liverpool, and Glasgow, are the sole manufacturers. There is nothing employed in the construction of the lamp upon which American petroleum or paraffin oil will act destructively; there is no physical possibility of the flame burning back upon the oil within the lamp; and to excess all the working parts are strong and staunch. Numbers of the lamps are already in use in this country, in the



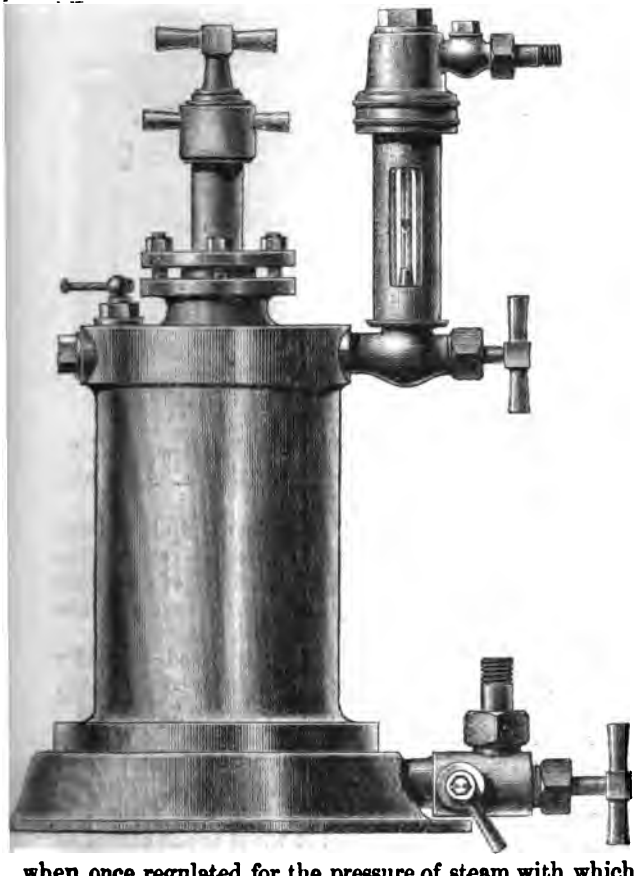
colonies, and abroad; and it is a safe prediction that wherever safe, economical, and efficient lighting is required there sooner or later the Doty lamp will be found.

The lamp, as shown in the illustration, is a galvanised, weather-proof, wrought-iron cylinder, 21 in. high, and 18 in. in diameter. A universal tool for all needful manipulations of the lamp rests upon the left-hand bottom side. The handle in front of the pressure gauge is that of an air pump, and the working air pressure runs from 10 to 15 lbs. Assuming the cylinder to be three parts filled with petroleum or paraffin, a few strokes of the air pump will give the required air pressure. This air pressure, which is on the top of the oil, will have forced oil up a tube set vertically inside from the cover of the cylinder to near the bottom. This tube also extends externally beyond the cover of the cylinder, and then, after receiving a wheel valve, it becomes an upright coil,

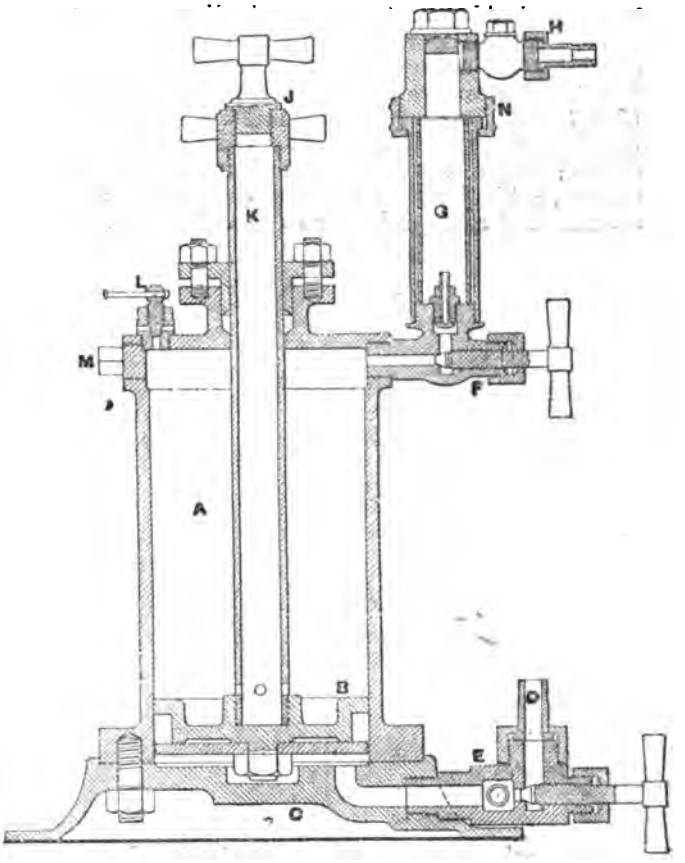
as shown. Brazed to the end of the upright coil is a rod, also shown, the foot of which is passed under the upright coil to form a burner. Such is the simple mechanism of the Doty Lamp. To put it in action, with its supply oil and air pressure, a saucer under the burner, within the upright coil, has half a gill of oil let into it from a branch pipe and set fire to. This heats the upright coil sufficiently to convert into vapour the oil passed through it by the wheel valve. Flame forms at once, as shown, which, as Professor Lambert states, attains in five minutes to full brilliancy and volume, consuming oil and atmospheric air from the bottom of the upright coil. Captain Doty, the inventor, in short, has achieved a commercial success in providing, in an especial manner, for shipowners and shipbuilders, and engineers and founders, a portable artificial daylight. The offices of the Doty Company are Mansion House Chambers, 11, Queen Victoria Street, E.C.

THE STEAM CYLINDER LUBRICATOR.

THE accompanying illustrations represent a new form of positive sight feed lubricator, as introduced by the Steam Cylinder Lubricator Company, of Standard Chambers, King Street, Manchester. As will be seen from the sectional elevation, the supply of lubricant does not depend upon the displacement of the oil by the condensation of a certain quantity of steam, but upon the direct action or pressure of the steam itself, and thus,



when once regulated for the pressure of steam with which it has to work, a positively uniform feed is kept up. As will be seen from the illustration, the oil chamber, A, has working within it the asbestos-packed steam-tight piston B, into the top side of which is screwed the hollow piston rod, K, working through a stuffing box as shown, and



indicating by its relative position the level of oil in the chamber. A filling plug, J, at the top end of the rod, serves to admit the oil, through the small holes at the bottom of the tubular rod, into the chamber. The steam inlet is at D, while connection with the cylinder to be lubricated is made at H, the plug, M, allowing of this being placed at either side by changing over the sight feed, G, and valve, F, to the place of the plug, and plugging with M the opening so left. An air valve is provided at L, and a drain cock at E, the whole apparatus being mounted on the base C.

If now steam be admitted to the underside of the piston, the difference in area between the under and upper sides, due to the area of the rod K, will cause the piston to raise and so displace the oil above it, which finds its way through the valve, F, sight feed, G, and connection, H, to the steam pipe or chest to be lubricated.

As will be seen, this lubricator is very easy to fix, and by attaching extra sight feeds, G, it may be used to lubricate two or more cylinders or chests.

We are told that the lubricator works well from 1 to 200 drops per minute, and as there is no water of condensation to mix with the oil, the sight glasses do not become dirty, an important point where accuracy of feed is needed. For fewness of parts and compactness the present lubricator compares favourably with any in the market, while its positive feed and nicety of regulation ensures the flow of oil being constant and perfectly under control, so effectually preventing all waste.

EXHIBITS OF MESSRS. ALLEY & MACLELLAN AT THE GLASGOW EXHIBITION.

MESSRS. ALLEY & MACLELLAN, of the Sentinel Works, Glasgow, have on view a very fine display of their various specialities, including examples of "Sentinel" steam steering gear for vessels from 500 to 5000 tons register, a typical form of which we illustrate herewith; "Sentinel" ash hoist; "Sentinel" reversing engine; also a Westinghouse high-speed engine and dynamo, a Westinghouse ordinary engine, and a large assortment of steam and water valves and fittings.

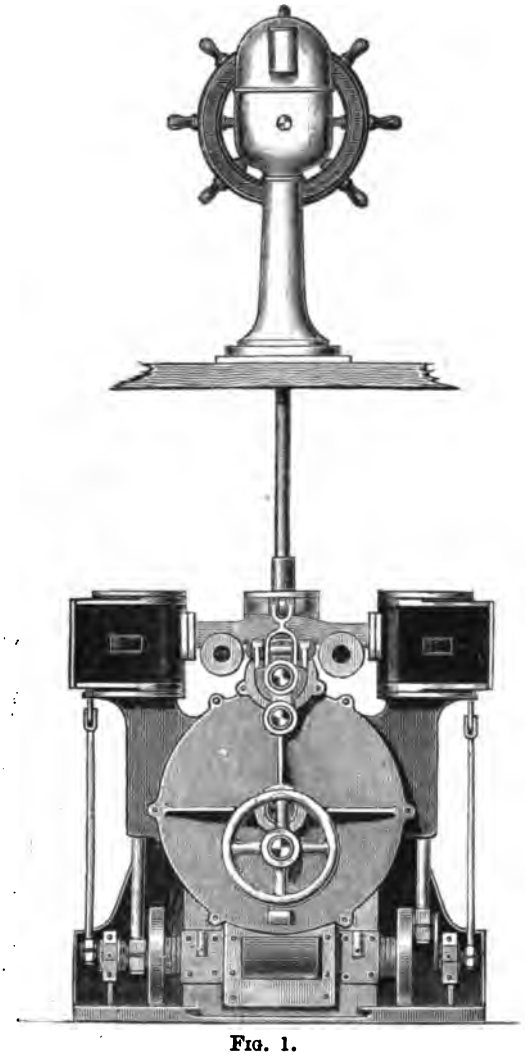


FIG. 1.

Of the accompanying illustrations of the "Sentinel" steam steering-gear Fig. 1 shows an end elevation, and Fig. 2 a side elevation of a gear suitable for a vessel of 3,500 tons gross, the outside dimensions of which are, extreme length, fore and aft, 6 ft. 3 in.; extreme breadth, athwartships, 4 ft. 6 in. Truly a small enough deck space for a gear capable of putting the rudder of such a ship from "midships" to "hard over" in seven seconds.

The illustrations give a good general idea of the gear which, as will be seen, may be either steam alone, or steam and hand combined, and in either case independent steering may be effected from any convenient station in the ship; thus, in the example shown, a small hand-wheel is fixed on the bridge immediately over the gear.

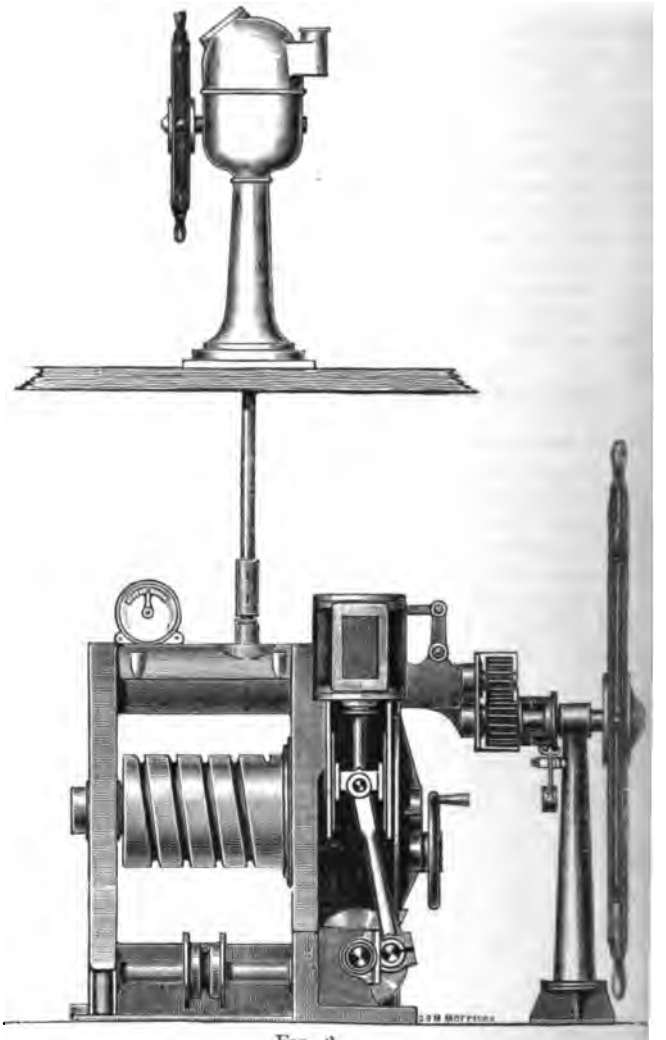


FIG. 2.

Without going into any further details we will briefly enumerate some of the advantages of Messrs. Alley and Maclellan's "Sentinel" gear.

Everyone has heard that steam gears eat up too much steam, and that a steam-steered vessel is either too sluggish in her courses (due to the slowness of the gear used in reversing) or flies to the opposite extreme, by the gear's running away when once reversed.

Now the first defect can only be attributed to badly designed valve arrangements, which soon become leaky, and the second to bad reversing gear. In the "Sentinel" the valves are so constructed that they take up the wear of the faces automatically, and they will work to the end without leaking, thus getting over the first objection. Second, in the "Sentinel" the reversing action is very sharp, the movement in either direction of the wheel to the extent of one spoke reversing or stopping the engine, and this allows of the "Sentinel" being used at sea with perfect confidence. In addition to this the "Sentinel" gear is

quite noiseless, no spur gearing being used in its construction.

Only the very best materials are used in the construction of these gears, and the workmanship leaves nothing to be desired, and as no gear leaves the works without a ten hours' absolute trial, they may be relied on to perform well when afloat.

Amongst others who have fitted these gears we may mention Sir W. G. Armstrong, Mitchell & Co., for the Italian Navy; Bengal and North Western Railway Co.; Palmer's Shipbuilding and Iron Co., Jarrow; Gourlay Bros.; M'Ilwaine, Lewis & Co.; Withy & Co.; Napier, Shanks & Bell; Archd. M'Millan & Sons; Simons & Co.; R. Duncan & Co.; Grangemouth Dockyard Co.; Scott and Co., and Russell & Co.; all of whom have given repeat orders for the gear, while single orders have been given by, amongst many others, Messrs. W. Denny and Bros.; Swan & Hunter; Oswald, Mordaunt & Co.; Hawthorn, Leslie & Co., &c.

Perhaps the next most interesting exhibit (to marine engineers) on Messrs. Alley & Maclellan's stand is their "Sentinel" ash hoist, and as we intend illustrating this in our next issue we will only briefly notice it here. Its chief feature is an arrangement to prevent overwinding the buckets, always a source of danger with the ordinary winding arrangements, and so perfectly does it do its work that it is impossible to overwind with it.

We may mention that it is already in use on board vessels of the English, Italian, and Spanish Royal Navies, and also in a number of large steamers.

The "Sentinel" reversing engine, for working the reversing gear of large marine engines, is a very neat and compact machine, fitted with the same arrangement of valve gear as the steering gear, by which an absolutely certain and quick reversing action is ensured.

There are many interesting exhibits on this firm's stand, and no marine engineer ought to visit the exhibition without inspecting them.

WOODITE.

"WOODITE" is already known to the marine engineer as the material of excellent inadhesive "Woodite" packing rings and valves, which are not acted upon by high pressure steam, grease, salt water, acids, nor gases; but hereafter, "Woodite," in varied quality or preparation, has manifold applications for sea and land. One of its forms, with properties kindred to whalebone, takes the name "Whaleite," and is made use of in the manufacture of horse boots and shoes. Another form is for wheel tyres, &c. The "Woodite" show rooms at 13 and 10, Delahay Street, Great George Street, Westminster, S.W., overflow with applications and specimens, as substitutes for rubber, leather, and asbestos, which are antifrictional and homogeneous in texture, and guaranteed against splitting or stratifying. In these days of women's rights it will surprise no one that the inventor is a lady. Mrs. Wood's handiwork is "Woodite." She is endowed with the ingenuity which too generally has been regarded as an exclusive attribute of the other sex; and, from small beginnings, new and far-reaching developments now reward her genius. In marine applications, especially, Mrs. Wood recalls Mr. Plimsoll, with his animated period, only in all things Mrs. Wood excites no controversy, and is intensely practical. The other day she was at the seaside stirred with a sense of the insufficiency of the means of saving life from shipwreck, and had the satisfaction of arranging what was the best means of protecting a life-boat with "Woodite" side paddle-wheels.

Unlike some inventors, Mrs. Wood has no wish to insist upon her baby and no other. She provides a life-boat for the oar, somewhat after the common type; one of Mrs. Wood's life-boats being reversible and unsinkable. The innovations are momentous, and may well command the attention of the Steamship companies. No one will say that on shipboard generally the life-boat means for saving life are equal to the demand that may possibly be made upon them; and surely, if a spark of gallantry is left in manhood, the invention of a lady in life-boats will not be passed by lightly.

Allied to the life-boat is the life-buoy, and Mrs. Wood's has attractive points. Practically it is indestructible, which means that in the long run it may prove cheaper than any other. Were it to be cut to pieces each part would float separately, and support its man. Were it not to be cut to pieces, but used as it is, its buoyancy would be found to much exceed that of the ordinary life-buoy.

Still allied to life-saving is Mrs. Wood's patent flexible bulkhead. This is a "Woodite" screen arrangement, for use against the inflow of water after collision or other accident; and while primarily the invention is for war, it is not outside of the attention of the mercantile marine. The "Admirals" have examined and discussed the flexible bulkheads, and it is an open secret that it is much approved by them. Why not? Anything to localise a water inflow, and preserve the trim of a ship from being seriously disturbed, is as common-sense a provision as life-buoys or life-boats. Nor does it appear that the expense is at all serious.

Last, Mrs. Wood thinks that an ironclad should not sink even when riddled with shot between wind and water. Numerous target experiments with steel shot and shell point in a qualified sense to that conclusion: the qualification being, that as a land target may be battered to destruction, so *à fortiori* may a ship. The reasonable contention of Mrs. Wood, however, is that as one form of "Woodite" will close upon a shot hole as water closes upon a stone thrown into it, the proceeding would be a common-sense one to substitute "Woodite" blocks for armour plates upon the sides of our armour clads.

Altogether "Woodite" is a remarkable invention, and Mrs. Wood places the female character in a novel, interesting, and highly creditable light. The womanly feeling for the safety of those who go down to the sea in ships has at length found noble and adequate expression.

A STEAM LIFEBOAT.—At the beginning of the present year a model of a steam lifeboat was submitted to the National Lifeboat Institution by Messrs. R. & H. Green, of Blackwall, which, having passed through various modifications as the result of consultation with the committee and their professional officers, was accepted by the institution, and Messrs. Green have now been instructed to build, as an experiment, a steam lifeboat on the proposed principle. The new boat is to be 50 ft. long with 12 ft. beam, and to be propelled by a turbine wheel, worked by an engine, developing 170 H.P.

DAVIS' PATENT STEAM STEERING GEAR FOR IRONCLADS OF 10,800 TONS.

IN a former issue, namely, that of May, 1887, we recorded the result of an inspection under steam of a very powerful set of steam steering gear then being built by Messrs. Davis & Co., Limited, of Garford Street, E., for a Russian ironclad of 10,800 tons.

We now have pleasure in noting that this well known firm have shipped a third set of this colossal gear, this, the latest set, being intended for the Russian ironclad *Sinope*, of 10,800 tons, now building at Sebastopol. These three sets of gear, together with eight other similar, but smaller sets, designed for use on cruisers, have all been shipped from the Garford Street works within the past twelve months, a fact which bears ample testimony to the capability and resources of this firm for turning out gear of the most powerful class.

The steam steering gear is of Messrs. Davis & Co.'s well-known horizontal type, with two cylinders each. Two sets of hand gear are provided, and these together with the steam gear are interchangeable, and so arranged as to allow of steering being effected from different stations in the vessel.

As in the two previous sets, the present gear is also provided with an auxiliary wire rope hand steering gear to be used only as a last resource when the other methods are damaged in action.

The gear is fitted with Messrs. Davis' improved form of sprocket wheel, by which greatly increased power over the chains is obtained, and that, to, with less liability to injure them, while any slack can be readily taken up by causing the chains to pass under adjustable roller guides.

We may state that, for hand steering purposes four large wheels are provided.

The same high class of design and workmanship and excellent quality of materials which characterises the productions of this firm, are just as observable in these large sets of gear as in the smaller ones, and we congratulate the firm on the high efficiency of their outputs, and the continued and well merited patronage which they receive.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.

REPORT OF THE COUNCIL ON THE HORSE POWER OF MARINE ENGINES.

IN endeavouring to frame a general rule for Horse Power the Council has proceeded on the basis of *Indicated* Horse Power.

But it is evident that for any rule to be general in its application which involves indicated power, all engines must be assumed to conform to certain conditions, which conditions must be looked upon as normal, all other conditions being of course regarded as abnormal. Unless normal conditions be granted it is obviously impossible for any general rule to be formulated. The result given by the rule will therefore be called Normal Indicated Horse Power (N.I.H.P.)

With a view to presenting the matter in as clear a light as possible, the rule which the Council has decided to recommend will first be stated and defined; the conditions which have been assumed as normal to all engines of the class dealt with will next be given and explained by reference to the Tables appended; and lastly the process by which the rule has been deduced in accordance with the above-mentioned conditions will be exhibited and explained step by step.

I.—The Rule.

Let D = diameter of low-pressure cylinder in inches.
(If there be more than one low-pressure cylinder, let D^2 = sum of the squares of the diameters.)
S = stroke of piston in inches.
P = working boiler-pressure in lbs. per square inch above the atmosphere.
H = heating surface of boilers in square feet.
P_M = mean-pressure in lbs. reduced to low-pressure cylinder.
R = revolutions per minute.

The following rule gives the maximum Normal Indicated Horse Power (N.I.H.P.), on loaded trial trip, of surface condensing marine Screw Engines working at any boiler pressure between 50 lbs. and 250 lbs. per square inch, under the conditions hereafter specified as "normal:"—

$$\text{N.I.H.P.} = \frac{(D^2 \sqrt[3]{S} + 3H)\ \sqrt[3]{P}}{100}.$$

II.—Conditions assumed as Normal.

1.—That the steam, whatever may be its boiler pressure between 50 lbs. and 250 lbs. per square inch, is expanded by the engines to the same terminal pressure.

This condition is necessary for the purpose of arriving at the power of the engines by themselves, but it is modified in its application by the rule under certain circumstances when the boilers are taken along with the engines, as will be explained further on.

2.—That the expansion is effected by the engines with the same degree of efficiency for all pressures between 50 lbs. and 250 lbs. per square inch.

This condition secures that for the higher pressures, engines of triple, quadruple, or more expansions must be used, the number of expansions depending on the pressure.

As a result of Conditions 1 and 2 it follows that the mean-pressure reduced to the low-pressure cylinder (P_M) may be assumed as proportional to the cube root of the boiler-pressure ($\sqrt[3]{P}$), and further that its actual loaded trial trip value may be taken without sensible error as $5{\cdot}6\sqrt[3]{P}$.

See Table I. for proof of this.

3.—That the piston speeds of engines of different lengths of stroke are proportional to the cube root of their respective strokes; and further, that the actual loaded trial trip value of piston speed may be taken as $144\sqrt[3]{S}$.

See Table II. for the variation of piston speed with length of stroke under this condition.

4.—That in all cases where the engines and boilers bear to each other such proportions as to prevent Condition 1 from being fulfilled, without thereby violating Condition 3, the coal consumption per I.H.P. will not be affected, but will be constant for the same boiler pressure.

When the engines and boilers bear a certain proportion to each other, which proportion is indicated in equation (C) further on, Condition 1, in conjunction with Condition 2, secures that the coal consumption will be constant for the same boiler pressure.

But when the engines and boilers vary, in their relative proportions, from what is here called the normal proportion, it is necessary that Condition 1 should be departed from, if the coal consumption is to be preserved constant for the same pressure, and if Condition 3 is not to be violated. Table IV. shows how nearly the rule fulfils this condition, with a variation of as much as 20 per cent. above and below the normal between the engines and boilers. This amount of variation may be expected to occur very seldom in practice.

5.—That the boilers are constructed in accordance with what will be generally recognised as the fair average practice of the present day in respect of the allowance of steam room in relation to power, the diameter, area, and pitch of the tubes, the relation of grate to heating surface, and the area of uptakes and funnel; that average natural chimney draught is used, or if forced draught be employed, that it does not exceed the average chimney draught; that the horse power is proportional to the heating surface (H) and to the cube root of the pressure ($\sqrt[3]{P}$); and, further, that the actual loaded trial trip horse power may be taken as $\frac{H\sqrt[3]{P}}{16}$.

See Table III. for the allowance of heating surface under different boiler pressures.

6.—That the efficiency of the engine mechanism is constant, and that the propeller is such as to secure that the engines will utilise the boiler power referred to in Condition 5, in the manner prescribed in Conditions 3 and 4.

III.—Deduction of the Rule.

$$\text{I.H.P. of engines} = \frac{\cdot 7844\ D^2 \times Pm \times 2SR}{33000}$$

$$,, = \frac{\cdot 7854\ D^2 \times 5{\cdot}6\ \sqrt{P} \times 144\ \sqrt[3]{S}}{33000} \left\{ \begin{matrix} \text{Conditions} \\ 2 \text{ \& } 3, \\ \text{Tables I. \& II.} \end{matrix} \right.$$

$$,, = \frac{D^2\ \sqrt[3]{PS}}{52} \quad \text{(A)} \quad \text{(By reduction.)}$$

$$\text{I.H.P. of boilers} = \frac{H\ \sqrt[3]{P}}{16} \quad \text{(B)} \quad \left\{ \begin{matrix} \text{Condition 5,} \\ \text{Table III.} \end{matrix} \right.$$

From the above it is evident that A and B are equal.

$$i.e. \quad \frac{D^2\ \sqrt[3]{PS}}{52} = \frac{H\ \sqrt[3]{P}}{16}.$$

$$\therefore \quad H = \frac{D^2\ \sqrt[3]{S}}{3{\cdot}25} \quad \text{(C)}$$

Equation (C) expresses the normal relation between the engines and boilers referred to in the explanatory clause following the Condition 4.

Assuming that the power of the engines and boilers when taken together will be equal to the mean of their separate powers, we have:—

I.H.P. of combined engines and boilers

$$= \frac{\frac{D^2\ \sqrt[3]{PS}}{52} + \frac{H\ \sqrt[3]{P}}{16}}{2}$$

$$= \frac{(D^2\ \sqrt[3]{S} + 3{\cdot}25H)\ \sqrt[3]{P}}{104} \quad \text{(By reduction.}$$

This expression may without sensible error, and for convenience, be written:—

$$\text{N.I.H.P.} = \frac{(D^2\ \sqrt[3]{S} + 3H)\ \sqrt[3]{P}}{100} \quad \text{Q.E.D.}$$

Notes.

1.—The only step in the above process of deduction which calls for further explanation is that by which the combined power of the engines and boilers is found by adding their separate powers and dividing by 2.

This step, though arbitrary, will be found to give results which very nearly conform to Condition 4, according to which condition the coal consumption per I.H.P. remains constant for any given pressure, even though the boilers vary from their usual proportion relatively to the engines.

Table IV. is, therefore, the justification for this step; and from this table it will be seen that the power given by the rule approximates very closely indeed *to the only power* which meets the proviso of a constant economy for a given working pressure, under varying relations of boilers to engines.

2.—For Paddle Engines the same rule may be used, with its coefficients modified to meet the altered condition of piston speed which usually obtains in these engines. Assuming that under Condition 4 the piston speed of paddle engines may be taken at 90 $\sqrt[3]{S}$, the rule may, without sensible error, be written:—

$$\text{N.I.H.P. of Paddle Engines} = \frac{(D^2\ \sqrt[3]{S} + 5\ H)\ \sqrt[3]{P}}{160}$$

and Equation (C) would become: $H = \frac{D^2\ \sqrt[3]{S}}{5{\cdot}2}$

3.—The Council considers the term "Nominal Horse Power," as at present used, very indefinite and misleading as a measure of the power of marine machinery. If however, instead of *Indicated* power, a quantity be required which will compare more nearly with what is known as "Nominal Horse Power," the above rule may be used thus:—Nominal Horse Power $= \frac{\text{N.I.H.P.}}{6}$

TABLE I.

Showing how the Mean Pressure (Pm) reduced to the L.P. Cylinder varies with $\sqrt{P}$, and that the Normal Pm may be assumed equal to $5{\cdot}6\ \sqrt[3]{P}$.

Boiler Press. = P.	Absolute Press. = P_1.	$\frac{P_1}{15} = R.$	$1 + \text{H. Log. } R = C.$	$P_1C - 6 = M.$	$M \times {\cdot}663$ (Pm as calculated.)	$\sqrt[3]{P}$.	$5{\cdot}6\sqrt[3]{P}$ (Pm assuming it to vary as $\sqrt[3]{P}$.)	Error per Cent.
50	65	4·33	·569	30·985	20·543	3·684	20·630	+·421
60	75	5·	·522	33·160	21·978	3·915	21·924	−·246
70	85	5·66	·483	35·055	23·241	4·121	23·077	−·710
80	95	6·33	·449	36·655	24·302	4·309	24·130	−·712
90	105	7·	·420	38·100	25·260	4·481	25·093	−·665
100	115	7·66	·396	39·540	26·215	4·641	25·989	−·869
110	125	8·33	·374	40·750	27·017	4·791	26·829	−·700
120	135	9·	·355	41·925	27·793	4·932	27·619	−·630
130	145	9·66	·338	43·010	28·515	5·065	28·364	−·532
140	155	10·33	·322	43·910	29·112	5·192	29·075	−·127
150	165	11·	·308	44·820	29·715	5·313	29·752	+·124
160	175	11·66	·296	45·800	30·365	5·429	30·402	+·121
170	185	12·33	·285	46·725	30·978	5·539	31·018	+·129
180	195	13·	·274	47·430	31·446	5·646	31·671	+·542
190	205	13·66	·264	46·120	31·903	5·749	32·194	+·904
200	215	14·33	·255	48·825	32·370	5·848	32·748	+1·154
210	225	15·	·247	49·575	32·868	5·944	33·286	+1·255
220	235	15·66	·239	50·165	33·269	6·036	33·801	+1·603
230	245	16·33	·232	50·840	33·706	6·127	34·311	+1·763
240	255	17·	·225	51·375	34·061	6·214	34·798	+2·118
250	265	17·66	·219	52·035	34·499	6·299	35·274	+2·197

TABLE II.

Showing the Piston Speed and Revolutions, on the assumption that the Normal Piston Speed is equal to $144\ \sqrt[3]{S}$.

S. Stroke in Inches.	$\sqrt[3]{S}$.	$144\ \sqrt[3]{S}$. Piston Speed in Feet per Min.	Revolutions per Minute.
16	2·52	363	136·12
18	2·62	377	125·66
21	2·76	397	113·42
24	2·88	415	103·75
27	3·00	432	96·
30	3·10	446	89·2
33	3·20	461	83·81
36	3·30	475	79·26
39	3·39	488	75·07
42	3·47	500	71·42
45	3·557	512	68·2
48	3·63	523	65·37
51	3·70	533	62·70
54	3·77	544	60·4
57	3·84	554	58·2
60	3·91	563	56·3
63	3·98	573	54·57
66	4·04	582	52·9
69	4·10	590	51·3
72	4·16	599	49·9
75	4·21	607	48·56
78	4·27	615	47·3
81	4·33	623	46·1
84	4·38	631	45·

TABLE III.

Showing how the amount of Heating Surface per normal Indicated Horse Power varies with the Boiler Pressure, on the assumption that this Horse Power equals $\frac{H \sqrt[3]{P}}{16}$

Boiler Pressure (P).	Square Feet of H.S. per Normal I.H.P. $\left(=\frac{16}{\sqrt[3]{P}}\right)$
50	4·34
70	3·88
90	3·57
110	3·329
130	3·159
150	3·011
170	2·888
190	2·783
210	2·691
230	2·611
250	2·54

TABLE IV.

Showing that the Heating Surface may be varied to the extent of 20 per cent. above or below the normal amount, and that even under such circumstances the Rule gives the Horse Power which will be obtained if the Coal Consumption is sensibly constant for any given Boiler Pressure. (For Illustration, assume Screw Engines $\frac{27'' - 43'' - 70''}{45''}$)

D.	S.	P.	H.	$\frac{D^2 \sqrt[3]{SP}}{68}$ Engines.	$\frac{H \sqrt[3]{P}}{16}$ Boilers.	$\frac{\text{Engines + Boilers.}}{2}$	$\frac{(D^2 \sqrt[3]{S+3H}) \sqrt[3]{P}}{100}$ (N.I.H.P.)	Normal Piston Speed.	Pm	Engine Efficiency.	Boiler Efficiency.	Total Efficiency or Coal Consumption.
70	45	150	$\frac{D^2 \sqrt[3]{S}}{3·25}$ = normal = 5363	1780	1780	1780	1780	512	29·81	100	100	100
70	45	150	20 greater = 6435	1780	2135	1958	1950	512	32·66	96·7	105·9	101·3
70	45	150	20 % less = 4290	1780	1424	1602	1609	512	26·95	104·12	92·16	98·14

THE GLASGOW INTERNATIONAL EXHIBITION OF INDUSTRY, SCIENCE, AND ART.

II.—NAVAL ARCHITECTURE.

IN the article in our last issue dealing with the exhibition as a whole, promise was made to return to various sections in subsequent issues, and treat them more in detail. We accordingly proceed to follow out our intention, and take up the subject of naval architecture as forming the topic on which our readers and the majority of the visitors to the Glasgow display will be most curious. Perhaps it would have been more in order to have first dealt with the materials of which ships are constructed, then the ships themselves, followed by the propulsive agents with which they are fitted, and the multifarious items of their equipment. The subject of iron and steel manufacture, however, will form the subject of a detailed article in next issue, and it will be followed by similar articles dealing with marine engines and ship machinery generally.

Readily lending itself to illustration by means of small-scale models, shipbuilding has naturally formed the subject of extensive and interesting representation in many previous exhibitions held throughout the United Kingdom and abroad within recent years. Perhaps the most notable collection was that brought together at Liverpool two years ago, and with this we dealt very exhaustively at the time. As very many of the models now shown at Glasgow were also shown at Liverpool, we think it would be needless to enter upon any lengthened notice of them now, and we accordingly dispose of most of these very briefly in the following article. Many noteworthy and entirely new exhibits, however, are to be found in the Kelvingrove display, and to those we devote more attention and space.

Regarding the models in respect of the class of vessels they are intended to represent, the most attractive and interesting are undoubtedly the models of the war ships, of which so many have been turned out on the Clyde and other centres within recent years, together with the models exemplifying the most recent developments in ocean mail and passenger service — in other words, the typical modern ocean steamship. The war ships we must defer noticing until a future issue, but the ocean steamships we at once proceed to deal with, and we propose in doing so to trace the most important and recent steps which have led up to the present important movement exemplified in such steamships as the Cunarders *Umbria*, *Etruria*, and the Inman and International Company's *City of New York* and *City of Paris*.

From the time when Brunel's and Russell's colossal design *The Great Eastern* was seen to be a failure, the development in size of steamships received a decided check, and attention was thereafter directed more to effecting improvement in the propulsive agents. The first great step in this direction was the introduction of the compound type of marine engine by John Elder. The compound principle had been adopted in stationary engines for a number of years, but its first application on shipboard was in the engines of the s.s. *Bandon*, constructed by Messrs. Elder & Co. in 1854. The success of these engines was demonstrated by an important reduction in the consumption of fuel. At that time the coal consumption with the best non-condensing engines was from 4 to 4·5 lbs. per I.H.P. per hour, whereas it was reduced in the *Bandon* to 3¼ lbs. The success of the compound engine was undoubted, yet shipowners were slow to recognise the advantages of its application, and it was not till after the adoption of the surface condenser about 1860-65 that the compound engine came into general use. These improvements, together with the adoption of the multitubular boiler, enabled greater initial steam pressure to be used, resulting in a still more economical performance. These important advances have been but the stepping stones to the still more marvellous successes of the past twelve or fifteen years. During this period development in size, power, and speed has proceeded at a rapid rate, many of the most modern types of ocean steamers being little short of "Brunel's audacity" (as the *Great Eastern* has been called) in point of size, and a marvellous advance upon that renowned vessel as regards speed and propulsive power.

The strictly modern typical ocean steamship may be said to have resulted from the achievements of the *Britannic* and *Germanic* of the White Star Line. These vessels, which unfortunately are not represented in the Exhibition, were built by Messrs. Harland & Wolff, Belfast, and for a considerable time held first place in the Atlantic service in the matter of speed, but

in 1879 a decided step in advance was made in the production of the *Arizona* for the Guion Co. by the Fairfield Co. The proportion of engine power in this vessel (a model of which is included in the Fairfield Co.'s stand) greatly exceeded that in existing vessels, and grave doubts were entertained as to her strength being such as to withstand the great strain produced by the working of her enormous engines. In spite of misgiving, however, she proved an immense success and crossed the Atlantic at an average speed of twenty miles per hour. In September 1881 she made two remarkably fast passages across the Atlantic, the time outwards being seven days, eight hours, thirty-one minutes, and homewards in seven days, seven hours, forty-eight minutes. Such results inspired rival companies with the desire to eclipse them, and the demand for more and more powerful steamers, as a consequence, ensued. The *City of Rome* for the Inman Line, the *Servia* for the Cunard Company, and the *Alaska* for the Guion Line were constructed in 1881, all of which are represented in the Exhibition. The *Alaska*, which emanated from the stocks of the Fairfield Shipbuilding Company, broke the Atlantic record for fast passages in 1882, making the voyage from Queenstown to New York in seven days. The *Servia*, built by Messrs. J. and G. Thomson, of Clydebank, was less noted for speed than for dimensions and tonnage, and for being the largest vessel at that time constructed of mild steel. Following upon these vessels the *Oregon* was produced by the Fairfield Company for the owners of the *Alaska*, and was destined to eclipse all previous competitors in the matter of speed. She made a succession of very rapid passages, the best of them being from Queenstown to New York in six days, ten hours. The *America*, built in 1884 by Messrs. J. & G. Thomson for the National Line of steamships, was the next contribution to the swift racers contending for pre-eminence in the Atlantic service. This vessel, of which a handsome model is shown at the builders' stand in the Exhibition, while she remained on the Atlantic service was remarkably successful in attaining high speeds with a moderate expenditure of fuel. Her average time in crossing the "herring pond" was six days, thirteen hours, forty-four minutes. In 1885 the Cunard Company again entered the field, this time with two new and very powerful steamships, whose performances have, since their completion, been a continued series of successes, which altogether cast previous achievements in the shade. The vessels referred to are of course the well-known *Etruria* and *Umbria* from the stocks of the Fairfield Company, whose "fast passages" are almost monthly the subject of newspaper paragraphs. The latest and best of these achievements is the accomplishment by the *Etruria* of the outward passage from Queenstown to New York in six days, one hour and forty-seven minutes, giving an average speed over the whole voyage of 19·54 knots per hour. On the day previous to arriving at Sandy Hook she covered the remarkable distance of 503 knots. The whole performance must be considered one of the most striking achievements ever made in marine science.

The fifteen days' passage of the earliest Atlantic steamers has now been reduced to a little over six days, and matters at the present time are ripening for a further step in advance, not only as concerned with speed, but with the important element of comfort and safety as well. The two new Inman liners by J. & G. Thomson, the two new White Star liners building by Messrs. Harland & Woolf, and the new racer said to be under order from the Fairfield Company, and of which a model is shown by that firm, are sufficient testimony to the truth of this.

Vast improvements in machinery have been made during the past five or six years. Triple and quadruple-expansion engines, with boilers of corresponding enhanced capacity, are rapidly superseding the ordinary compound type of machinery, with better and more economical results. These later improvements are being embodied in British Atlantic liners for the first time in the *City of New York*, now nearly completed by Messrs. Thomson, and it is highly probable when the most approved type of engine, in conjunction with a form of hull specially related to the engine-power, are combined together, that higher rates of speed will yet be attained with a much diminished expenditure of fuel. The prophecy of Sir Wm. Pearce, made about five years ago at the trial of the *Oregon*, to the effect that "He trusted in a few years they would have a steamer that would go from this country to America within five days," would seem now to be less Utopian than it then appeared. The latest "greyhound" design by the Fairfield Shipbuilding Company of a steamer to cross the Atlantic in five days is represented in the exhibition in the model already referred to. This and the other models are very interesting, and attract a great deal of attention. If the models are exact representations of the vessels as regards form, there is quite a decided difference in the respective designs—the *City of New York* being considerably finer in the ends and fuller in the midship section than the proposed five days' racer. The *City of New York* is 560 ft. in length, over all, with a beam of 63 ft., and a moulded depth of 42 ft. She has five decks, and the promenade deck extends, unbroken, from end to end of the ship. On this deck is a long house containing a large number of specially-fitted passenger rooms. She is to be propelled by twin screws, the shaft-tubes being supported by massive stays. There are three masts, and between the fore and main mast are three funnels, in front of which is the bridge. The whole appearance of the model conveys the idea of power and swiftness in a striking way, and as a work of art it is most admirable, as indeed are all the models shown by Messrs. Thomson. The equipment details of these are really beautiful, and are the work of Messrs. Kelso & Co., Commerce-street, Glasgow, whose skill as model-makers is made evident on almost every second model throughout the collection. The Fairfield design represents a vessel of 563 ft. in length, 63 ft. in breadth, and 52 ft. in depth to upper deck, and tonnage of 11,500. She is also a twin-screw vessel, driven by engines designed to develop great power—the proportion of which to the actual tonnage of the vessel must be very large, judging from the space occupied by the engine hatches and funnels. She is lightly rigged with two pole masts, between which are her funnels, four in number, of enormous dimensions. One of the latest of the Atlantic "greyhounds" already built by the Fairfield Company, and represented in their collection, is the s.s. *Lahn*, built for the North German Lloyd's. She measures 448 ft. in length, 48 ft. 10 in. in breadth, and 36 ft. 6 in. in depth, with a gross tonnage of 5,660. This vessel is one of the few Atlantic liners fitted with triple-expansion engines, having a peculiar arrangement of cylinders, of which there are five. On the measured mile she attained a speed of 19·6 knots per hour, and crosses the Atlantic regularly at a mean speed of 17·5 knots.

Besides the models of war vessels and merchant steamers, constituting the exhibit of Messrs. J. & G. Thomson, they show a specimen of the state-rooms as fitted on board the two new Inman and International Liners, which, though unattractive externally, are beautifully finished in the interior, and excellently arranged for the comfort and convenience, not to say luxury, of passengers.

(To be continued.)

THE IRISH EXHIBITION.

THE Irish Exhibition opened on June 4th, at Olympia, Kensington, is to remain open for a space of five months, and will, we trust, during that time receive its fair share of visitors.

We need scarcely say that the object aimed at by the promoters of the exhibition is to place before the English public a clear view of the predominant industries of Ireland, and to awaken public interest in the very widespread efforts that are now being made to revive her trade, but we will say that we wish the promoters every success in their efforts, and that we sincerely trust much good may accrue to Irish trade as a result of the exhibition.

Though there is not much to be seen of special interest to our readers in what may be called the business sections proper, the exhibition as a whole affords an opportunity of spending a few pleasant and instructive hours, many Irish industries being well to the fore.

The exhibits are placed in avenues running the length of the building (Olympia), and lettered from A to I, but as no attempt appears to have been made at classification there is a somewhat miscellaneous gathering together in each avenue that is rather puzzling.

What little machinery in motion there is to be seen appears to be devoted to the production of linens, laces, embroideries, cloths, printing, glass cutting, &c., some of the products being very valuable, as we found out on innocently asking the price of some embroidered handkerchiefs, and which the young lady in charge tried to convince us were "rarely cheap" at £72 per dozen.

Among the mechanical exhibits Mr. William S. ence, of Dublin, has on view a 20 in. gauge locomotive of Geoghegan's patent, as used for indoor work at Guinness's brewery. It works at 180 lb. pressure, has a wheel base of 3 ft., and is capable of drawing a rolling load of 40 tons.

Our readers should not fail to see the exhibits of Messrs. J. Edmundson & Co., Limited, of 33 to 36, Capel Street, Dublin. This firm shows some nicely finished scale models of lighthouses, chiefly on a scale of one inch to the foot, including models of Tory Island lighthouse, and Tuskar Rock, Galley Head, and New Island lighthouses. They also show Wigham's Royal atmospheric gas-making machine, first order lighthouse lenses,

with Wigham's lighthouse gas or electric light burners, and models illustrating Wigham's patent tri and quadri form group-flashing gaslight lantern and illuminating apparatus, further models showing their occultating harbour light. Tory Island lighthouse, as fitted by Messrs. Edmundson, is provided with the largest lighthouse light in the world.

In the same avenue Messrs. H. Kennedy & Son, of Coleraine, Co. Londonderry, show one of their 15 in. "Empress" turbines and case fitted with their "Champion" governor.

In Avenue H Messrs. Samuel Irvine & Sons, of Brown Square, Belfast, have a very serviceable-looking life raft, made of solid corkwood in the form of two cylinders, having conical heads. The raft is provided with a deck on each side, and can be propelled by paddle, an arrangement of wheel being fitted, oars or sail. Taken altogether, we like the look of this raft, and think we should prefer it in case of a sudden emergency to a boat and the delays and dangers connected therewith. In avenue G, at the stall of the Rev. Father Davis, four boys from the Baltimore school are engaged making nets, fish boxes, &c., and they do their work very neatly and deftly. At the same stall plans of the school, &c., and a model ship are shown.

At the, numerically, next stall Messrs. Ismay, Imrie & Co. have a magnificent full model of the *Britannic* on view; while in close proximity are other models shown by Messrs. Workman, Clark & Co., Limited, of Belfast. These include models of a City Line passenger steamer, 400 ft. long, sundry cargo steamers, a passenger paddle steamer, sailing ships, yachts, hopper barges, and dock caissons, making altogether a very good and very representative show of this well-known firm's work. Next to these models Mr. W. E. C. Phelps, of Trinity College, Dublin, shows a model of a ten-ton racing cutter, and designs for a five-ton racing cutter. The model is well up to the average make of models, but gives one the impression, having regard to her depth and the spread of canvas carried, of being a trifle lacking in beam. In this same avenue the Right Hon. Lord de Ros, of Old Court, Strangford, Co. Down, shows the model of a neat invention. This is a miniature representation of a punt for small sailing boats, which divides longitudinally, and so allows each half to be stowed, one on either side of the sailing boat, either below or on deck. A full size punt so constructed can, we are told, be put together in three minutes.

Near to Lord de Ros's exhibit the Belfast Ropework Company, Limited, of Belfast, make a very fine and extensive show of their specialities. Amongst other things that we noticed on this stand were some very good quality and well made Manilla and Russian hemp ropes of various sizes, for shipping, while among the smaller exhibits were samples of sash cords, plaited and laid, fishing lines, log and balliard lines, twines, &c., all being of high quality, both as regards materials and workmanship.

Perhaps the only exhibit calling for our special attention in avenue F is the full-rigged model of the P. and O. steamships *Oceana* and *Arcadia*. These vessels, built by Harland & Wolff, of Belfast, have a length of 468 ft., a breadth of 52 ft., and a depth of 37 ft., with a tonnage of 6,362 tons, and engines indicating 7,000 H.P. The model has an additional interest, as representing the P. & O. Co.'s Jubilee fleet, the *Victoria* and *Britannia* being the remaining two. All these vessels have passed the Admiralty survey as armed cruisers, and are fitted with gun platforms, &c.

Owing to the incomplete state of the exhibition at the time of our visit, several exhibits which we should like to have noticed could not be seen, and our reference to these must therefore stand over until our next issue.

THE ITALIAN EXHIBITION.

THE first exclusively Italian exhibition held beyond the boundaries of the Peninsula is now in full progress in the grounds formerly occupied by the American Exhibition at West Brompton.

With the exception that the gardens have been laid out and built upon to represent Italian scenes, and that the space allotted to Buffalo Bill's Wild West Show of last year has for the present been converted into "The first genuine reproduction of the Roman Coliseum ever constructed," but few structural alterations have been made; and, indeed, but for the erection of a few additional annexes, we do not think the main buildings, covering the exhibition proper, have been in any way interfered with.

To the strictly utilitarian we fear this exhibition will prove somewhat of a disappointment, but for those who can appreciate beauty of form, colour, and material, a veritable feast is provided, both as regards the interior and exterior parts of the exhibition.

The exhibition stands on a triangular piece of ground, having an area of some twenty-four acres, to which three railway stations, viz.: West Brompton, Earl's Court, and West Kensington, give direct access. The gardens proper occupy about one-half of this area, or twelve acres in all. In the larger, or west, garden, will be found a very unique and artistic reproduction of the famous blue grotto of Capri. This is very ingeniously contrived, real water and electric lighting being utilised to aid in heightening the effect, and should certainly be seen by every visitor, as should also a very fine and realistic panorama of the Bay of Naples. In this garden there are also to be seen the tent and hunting appointments of the late King Victor Emanuel (specially lent by the present king), the "switchback" railway (and this latter, by the way, appears to be rapidly gaining in popularity, if we may judge by the crowds waiting to make the trip); the Borghese gardens; the band stand, in the form of an Italian temple; the new annexes, in the form of Tuscan farm-houses; and last, though not least, the "Welcome" Club. In the central garden, nearer to the main exhibition, will be found a collection of objects more thoroughly typical of the country from whence they emanate. These include very finely coloured and designed reproductions of the Palazzo dei Signori of Padua; the façade of the Cathedral at Como; the Temples of Vespasian and Saturn; the Palace of the Cæsars; the Forum Romanum; the Arches of Titus, Constantine, and Septimus Severus; the Column of Phocas; the Via Sacra; the Cocus Vestalium; a street in Pompeii, &c.

We need scarcely say of an Italian exhibition that music, and that of the choicest, abounds in these gardens, nor need we here do more than refer to the truly magnificent collections of pictures and sculpture that are to be found indoors, but we must congratulate the management upon having got together, as the official catalogue has it, "the most valuable and varied collection of Italian sculpture and paintings ever exhibited."

The usual electric light appliances have been provided for illuminating both the interior and the grounds, and the effect, when the light is turned on in the buildings, where so much that is rich in colour abounds, is very pleasing. Among the many exhibits there are but few which, from a mechanical point of view, would specially interest our readers; indeed, the class (XII., Products of the Sea, Naval Architecture, and Fisheries) from which we hoped to glean the most information is entered by only six exhibitors, while in Class V., devoted to Mechanical Engineering, Machinery and Electricity, there are not more than a dozen exhibits which we shall have to describe.

Dealing with Class XII. first, and leaving over the description of the other exhibits until our next issue, we notice a well-arranged and most conspicuous display of models by the Italian Royal Ministry of Marine. The collection embraces models of about 30 ships of different sorts, and shows the progress made by the Italian Royal Navy from the date of the proclamation of Italian Unity (1861) up to the present. From the *S. Michele* frigate, giving us the style of the old sailing man-of-war, and the *Maria Adelaide*, *Garibaldi*, and *Caracciolo*, representing the screw wooden ships, we pass gradually by stages with ironclads to the types of the largest and most recent turret ships, amongst which we note the models of the *Duilio* and *Dandolo* (11,600 tons displacement, and 7,500 H.P.), and the *Italia* and *Lepanto* (14,000 tons displacement). The models of these are shown on a large scale, 1-25th full size, and represent a longitudinal section, showing completely the inside arrangements and all the mechanical parts of the ship. The *Italia* and *Lepanto* are about 401 ft. in length, 74 ft. in breadth, and are protected by 22½ in. armour; they carry four 100-ton guns, breech-loading, and throw a projectile of 2,205 lbs., with a charge of 408 lbs. There are six engines and twenty-six boilers in each ship, indicating 18,000 H.P., and giving a speed of about eighteen knots.

Besides the models of modern ships, there are also exhibited models of war ships of the Venetian Republic of the last century, and many others of smaller size, the whole forming a most valuable and most interesting collection.

In this class, and in addition to the models just noticed, Mr. A. T. Morgan, of 64, Albert Hall Mansions, S.W., exhibits a full-sized Venetian gondola, while the R. Scuola Navale Superiore, of Genoa, show models of ships and an album of hydrographic views executed by the pupils of the school.

Prof. Tagliacozzo-Volpignana has on view in this class a project, with plans and full descriptions, of "The Rome Port and Maritime Canal."

CARDIFF AND SOUTH WALES EXHIBITION.

NOT to be behindhand in these days of exhibitions, Cardiff proposes to open its exhibition early in September, and to continue the same for two months.

The exhibition will be held in a building specially erected for the purpose (upon a site granted by the Marquis of Bute) in a central position—Howard's Gardens—near the Taff Vale and Rhymney Railway Stations, and will be ready for the reception of exhibits by August 20th. Intending exhibitors may obtain all necessary information from the offices at Church Street Chambers, Cardiff, and 20, Bucklersbury, London, E.C., and judging from the fact that the exhibition will be held under the special patronage of the Marquis of Bute, and has a most influential list of patrons, we think we may safely assert that it will be a success, which will be still further contributed to by the management having been undertaken by Mr. Philip Shrapnel, a gentleman who has most successfully conducted a number of similar exhibitions in London and the provinces.

We shall have much pleasure in noticing in due course the various exhibits which may be of interest to our readers.

LAUNCH OF H.M.S. "MEDEA."

ON June 9th this twin-screw second-class cruiser, as she is called in the official Navy List, was successfully launched at Chatham. She is certainly a very pretty ship, and excited much interest, as she is the first of her class built in a Government yard. Her sister, the *Medusa*, however, also building at Chatham, is expected to be ready for launching in about six weeks. The first plate of the keel of the *Medea* was laid down on the 5th of April last year, so that she has only been 14 months on the stocks; but the Fairfield Shipbuilding Company, at Govan, on the Clyde, only commenced the construction of the *Marathon* and *Magicienne* in August last, and these two ships were launched some time ago and are expected to be completed and in all respects ready for sea by next November. The *Melpomene*, the remaining one of the five ordered, is building at Portsmouth. This quintette, designed under the supervision of Mr. W. H. White, Director of Naval Construction, is principally remarkable for the high speed aimed at in the ships composing it. Of only 2,800 tons displacement, the engines of 9,000 I.H.P. are expected to give them a speed of 20 knots always available on an emergency. High as this speed may seem, many naval officers are of opinion that no cruisers in the future will be efficient without it, having regard to the *Chanzy*, *Suchet*, *Tage*, and others that the French are building. The *Medea* and *Medusa* differ from the other three vessels, in that they are not sheathed with wood and coppered, but their bottoms will be simply coated with anti-fouling composition. It may therefore be presumed that they are intended for home or Mediterranean service, while the others may be expected to be detailed for distant stations. The addition of the sheathing and copper increases their displacement by about 150 tons, and will probably take a quarter of a knot off their speed. This disadvantage, however, will be more than compensated by the power of keeping the sea for longer periods without the necessity of going into dry dock to have their bottoms cleaned. The hulls are constructed entirely of steel, in the *Medea* of the variety known as Siemens-Martin; and, indeed, for shipbuilding purposes and engineering generally, the metal known for so many years as wrought iron has almost ceased to exist. The stem, stern-post, and rudder frame are castings of phosphor bronze, weighing together about 45 tons. This alloy is singularly impervious to oxidation and the attacks of sea-water, and a torpedo boat made of it is now under trial at Chatham. For protection from the projectiles of an enemy the *Medea* depends almost entirely on a steel turtle-back deck, two inches thick in the sloping parts at the sides of the ship, and one inch where it is horizontal. This is 4 ft. below the waterline, and it is considered that the chances are largely in favour of any shot striking the ship's side being deflected upwards by it, probably expending itself harmlessly in the air. Under this deck are arranged the vital portions of the vessel—the propelling engines, the boilers, the auxiliary machinery of every description, and the magazines. The coal bunkers are also disposed so as to afford additional protection, being 6 ft. in width, and subdivided transversely. The double bottom, on the cellular principle, is arranged for carrying water ballast. The interior of the hull is divided broadly by transverse bulkheads into ten watertight compartments, but these are again so subdivided that there are in all close upon 270 watertight spaces. The dimensions of the ship are 265 ft. long over all, 42 ft. beam, with a depth of hold of 23 ft. When fully equipped with stores, coal, &c., she is expected to have a freeboard of 12 ft. Let us hope this expectation will not be disappointed. In a class of ships designed expressly for speed it can well be understood that the engines and boilers must occupy a very large portion of the space below, especially when the H.P. is to the tonnage in the almost unprecedented proportion of more than three to one. The engines, by Messrs. Humphrys, of Deptford, are, it is needless to say, triple-expansion, with horizontal cylinders. The diameters of the cylinders are 34½ in., 51 in., and 76½ in. respectively, the stroke being 3 ft. The engines are mostly of steel, the shafting being tubular, and every part of the lightest possible scantlings consistent with safety, for, as may be imagined, the strain thrown on the framing at full speed will be enormous, while every additional pound of weight put into such a ship as the *Medea* by the engineers is jealously challenged by the naval architects. The total weight of the machinery was ordered by the Admiralty not to exceed 630 tons. There are four double-ended boilers, with corrugated flues, six in each, built to work at a pressure of 155 lb. on the square inch. Forced draught, with closed stokeholds, is, of course, a *sine qua non* for full speed, and is supplied by eight fans of the ordinary Navy pattern. Without the use of these fans, 5,500 H.P. is to be developed, giving a speed of about 17 knots. At ten knots the coal supply is sufficient for the *Medea* to steam for 8,000 miles, but this is not likely to be her *métier*. The armament of the ship is composed of 6 in. 5-ton breech-loading guns, on central pivot Vavasseur mountings—two forward, two aft, and one on each broadside; she will also carry ten quick-firing guns (6 pounders) and several machine guns. Six torpedo tubes are fitted, all under cover. The ship is lighted by electricity throughout, and will be furnished with three powerful search lights. She has two masts, but practically no sails, the fore and aft canvas she carries being only intended for steadying purposes when lying to in a gale of wind. There are no "military tops," and it is not unlikely that the use of these will in future be abandoned, as many authorities consider they will do more harm than good. The total cost is estimated at £152,500. Of her value for war purposes there can be no two opinions, and the sooner we have some more like her ready for commission the better. Miss Kelly, daughter of the Admiral Superintendent, performed the ceremony of naming.

THE TWIN-SCREW COMPOSITE SLOOP "DAPHNE."

ON May 29th the new twin-screw composite sloop *Daphne* was successfully launched from the building slip at Sheerness Dockyard in the presence of a large assemblage, including Admiral Charles L. D. Waddilove, Commander-in-Chief at the Nore, Rear-Admiral Sir Robert H. Moore Molyneux, K.C.B., Superintendent of Sheerness Dockyard, and the principal officers of the port and garrison. The prayers appointed for such occasions were read by the Rev. S. S. Browne, chaplain of Sheerness Dockyard, after which Miss Waddilove, eldest daughter of the Commander-in-Chief, named the ship and then cut the final cord, which launched her into the Medway. The *Daphne* is a sloop of the *Buzzard* type, and was designed by Mr. W. H. White, Director of Naval Construction. She is 195 ft. in length between perpendiculars, 212 ft. in length "over all," with a breadth of 30 ft., and a displacement of 1,090 tons. She was commenced on the 20th of June, 1887, and is now in a most complete state, requiring only her masts and engines to fit her for sea. It is expected that by the end of August she will be ready for the pennant, and, if the anticipations of the dockyard authorities in this matter are realized, she will have been built in a shorter period than any sloop in the Royal Navy, thus proving that the reforms lately introduced have accelerated the rate of work. The *Daphne* is built with steel frames and two thicknesses of teak, but in the construction of future ships of her class steel plating is to be substituted for the first skin of teak. The *Daphne* is unarmoured, but over her machinery and boiler spaces she is fitted with a steel protective deck having a considerable curve amidships, so that while the height of this deck above the water line, immediately over the boiler room, is 9 in., it is 4 in. just below the engines and 2 ft. 9 in. at the side just below the water line. The engine hatchways and other openings out of the steel deck are further protected by strong gratings, the hatchways and trunks themselves being

enclosed by cofferdams secured to the steel deck, and carried above the upper deck, so as to isolate the compartments and prevent their flooding from any sudden inrush of water. The *Daphne* will be barque rigged and will only carry yards on her foremast. Her propelling machinery has been manufactured by the Greenock Foundry Company at a cost of £15,150, and consists of two complete and independent sets of horizontal triple-expansion engines, direct acting and surface condensing. The steam is supplied from two circular boilers, each heated by three furnaces of corrugated steel. The crank and propeller shafts are of steel, and the propellers are of gun-metal. The engines, working under forced draught, are estimated to develop 2,000 H.P., and to propel the ship at a speed of 14½ knots. Her bunkers will hold 160 tons of coal, which is sufficient to enable her to steam 930 knots at full speed, and 3,000 knots at a reduced speed of 10 knots. The armament of the *Daphne* will consist of eight 5 in. steel breechloading guns, two of which will be carried on sponson ports forward, two aft, and four amidships. She will also be supplied with eight Gardner and Nordenfelt machine guns. The total cost of the *Daphne*, when completed for sea, is estimated at £60,082, or about £6,000 less than the *Buzzard*, the first of her type.

THE UNION STEAMSHIP CO.'S ROYAL MAIL STEAMER "TARTAR."

THE chairman and directors of the Union Steamship Company entertained a party of ladies and gentlemen on board their R.M.S. *Tartar*, on June 23rd, when a trip from Southampton, round the Isle of Wight, was made. This trip was to mark the completion of the directors' intention to convert the engines of their mail steamers from compound to tri-compound. The *Tartar* is the last of the mail steamers to be so treated, and the success in her case has been as great as in that of the other steamers. At her speed trial in Stokes Bay, on June 16th, she attained a mean speed of 15·355 knots per hour, which showed an increase of 1·08 knots over her performance with compound engines, and she developed 4,898 H.P., being 1,340 in excess of previous attainments.

The *Tartar* was launched on January 25th, 1883, by Messrs. Aitken & Mansel, at Whiteinch, near Glasgow, having been built specially for the Royal Mail Service conducted by the Union Steamship Company between this country and the South African Colonies. The *Tartar* is the forty-second vessel which the company has built or purchased. She is one of the handsomest of this already fine fleet, and her dimensions are—Length, 376·5 ft.; breadth, 47 ft.; depth, 30·3 ft.; gross tonnage, 4,339 with a displacement of 8,000 tons. In the construction of the *Tartar* the greatest care was bestowed to make her in every way a first-class ship, and to secure the greatest comfort and safety to the passengers. She is divided into thirty water-tight compartments, and has a double bottom constructed on the "cellular system," extending the whole length of the ship, and capable of containing 500 tons of water as ballast. Her main sheer strake is doubled, and she has two complete iron decks, which are covered with teak, as are also her bridge and forecastle decks. The ship is built to meet all the requirements of the Admiralty, and she has also the highest class at Lloyd's; in fact, in many respects is far above their requirements, her outside plating being doubled amidships to ensure greater strength.

In the construction of the *Tartar*, the Union Company departed from the old arrangement of first-class saloon and state-rooms, for in this ship these are placed amidships, immediately before the engine and boiler space.

The dining saloon is constructed on the upper deck forward, is 62 ft. long, of great height, and is capable of dining 110 passengers. It is handsomely decorated and luxuriously furnished, and contains the latest and most modern improvements. It, as well as all cabins, smoking-rooms, music-rooms, &c., is lighted by electricity, an installation of this light having been made throughout the ship by Messrs. Siemens Brothers. There are duplicate sets of engines and dynamos, each capable of furnishing power for 200 lights. There are 290 lamps throughout the ship, each of sixteen-candle power. There is a switch to every cabin lamp, so that the light is under the control of the individual passenger. Above the saloon is a large music-room and ladies' boudoir, opening on to the promenade deck, which deck is nearly 180 ft. long. On the after part of this deck is a large and luxurious smoking-room for first-class passengers. Under the hurricane deck and amidships is a large covered-in promenade for first-class passengers in bad weather. On the main deck the whole of the cabins fore and aft are furnished and fitted up in the best possible manner, the fronts being of maple or oak, and have a very handsome appearance. All cabins are fitted with patent lavatories by A. & R. Smith. The sleeping cabins, owing to the width of the ship, are unusually large, and wire-wove mattresses are fitted throughout. The baths are of marble; tesselated pavement and ornamental tiles are used in the bath-rooms and lavatories, and special attention has been paid to the sanitary arrangements. The whole of the main deck bath-rooms and midship cabins are provided with improved ventilators. Cooking ranges are supplied by Benham, of London, which are provided with every possible fitting required to meet the demands of a large number of passengers.

Every possible care has been taken by the company to provide for the different classes of passengers carried, the second and third-class saloons being divided by iron bulkheads, which are water-tight and fire-proof. Accommodation is provided for 153 first, 65 second, and 81 third-class passengers. A refrigerating engine and cold chamber have been fitted by Messrs. Haslam & Co., Derby, which will ensure for passengers a constant supply of fresh meat provisions, &c. (which will be shipped in England, and preserved throughout the voyage), and of ice.

There are eleven boats, six of them being lifeboats, and fitted with Bowers' patent davits, in addition to which two Berthon collapsible boats are carried, thus making the boat capacity in excess of the number of crew and passengers. All the boats are fitted with Hill and Clarke's patent disconnecting gear, and the lifebuoys with Holme's light and Jones's patent disconnecting apparatus. Sir W. Thomson's patent compass and sounding machines are supplied, as well as sixteen compasses for various parts of the ship, boats, &c.

The engines were originally constructed by Messrs. J. & J. Thomson, of the Finnieston Engine Works, Glasgow, and the cylinders were 50 and 94 in. in diameter, with a stroke of 60 in. The converted engines, by Messrs. J. Richardson and Sons, have now cylinders of 36, 58, and 94 in. diameter, the stroke being 60 in. The shafts and propeller are of steel, and manufactured by Vickers. Three large double-ended steel boilers are provided with Fox's corrugated tubes at a working pressure of 160 lbs.

The pumping power in the ship is very great, as in addition to the ordinary engine pumps, large pumps are fitted, which are capable of discharging several hundred tons of water per hour, and are so arranged that even after the fires in the main boilers are extinguished, the pumps can be worked by means of a large boiler on deck.

The *Tartar* has made the passage from Cape Town to Plymouth in 17 days 17 hours net steaming time, and it is anticipated she will excel this performance with her altered engines.

She sailed from Southampton on June 28th with the Cape of Good Hope mails.

RUSSIAN IRONCLAD FRIGATE.

ON June 1st the name day of the Grand Duke Alexis, High Admiral of the Russian fleet—a new ironclad frigate the *Pamiat Azoff* ("Memory of Azoff") was successfully launched from the Baltic Works, in the presence of the Emperor and Empress, the Heir-Apparent, the Queen of Greece, and other members of the Imperial family, and a brilliant assembly of officials. Immense crowds lined both sides of the Neva, and the river presented a gay appearance, owing to the presence of several Russian men-of-war, expressly gathered to welcome their new comrade. At 11 a.m. the Imperial party arrived, and was met by M. Kazy, the popular director of the Baltic Works, who conducted their Majesties over the frigate. Shortly before 12 the Emperor and Empress returned to their pavilion, which was prettily decorated. The order was then given to knock away the stays, and the gigantic frigate glided easily, without the slightest hitch, into the water, amid deafening cheers, while a military band played the National Anthem, and salutes were fired from the assembled vessels.

The *Memory of Azoff* is one of the largest frigates in the Russian navy, and has been named after its great ancestor, of Navarino fame, which was given the right of displaying the St. George's flag—a right now conferred on the frigate launched to-day. The following are the main dimensions of the new vessel:—Length over all, 385 ft.; beam, with casings, 50 ft.; draught, fore 21 ft.,

aft 25 ft.; displacement, 6,000 tons. Her armour will consist of plates made at the Admiralty works. The vessel will be armed with 14 rifled long range, 15 machine, and three torpedo guns. The engines, also built at the Admiralty works, will indicate 8,500 H.P., and the calculated speed is 16 knots. The construction was commenced in March, 1886.

Before the launch at the Baltic Works their Majesties laid the keel of a new Imperial steel yacht, to be named the *Polar Star*. Her chief dimensions are:—Length, 312 ft.; beam, 35 ft.; draught, fore 17 ft., aft 18 ft.; displacement, 3,640 tons; the engines to indicate 6,000 H.P.

THE NORDENFELT TORPEDO.

AN interesting and successful trial of the Nordenfelt electrically controlled torpedo took place in the Thames at Erith on Friday afternoon, June 15th, in the presence of a large company of British and foreign naval and military officers. Among those present were Admiral Sir Vesey Hamilton, Admiral Boys, Admiral Colomb, Captain Brook, R.N., Captain Wilson, R.N., Captain Drury, R.N., General Sir Lothian Nicholson, Colonel Lewis, Major Armstrong, Captain Schroeder, of the German Imperial Navy; Captain C. Rousseau, of the Austrian Imperial Navy; Captain Chadwick, Commander M'Calla and Lieutenant Buckingham, of the United States Navy; Captain Roustan, of the French Navy, and Colonel Massing, of the French Army; his Excellency Evaristo Casariego and Captain Torelli, of the Spanish Navy; Colonel Garcia, of the Spanish Army; and Count Condiani, of the Italian Navy. On arriving at Erith the visitors were conducted by Mr. Nordenfelt on board a steamer, which proceeded out into mid-stream to watch the experiments. The torpedo, which embodies all Mr. Nordenfelt's latest improvements, is of large size, measuring 35 ft. long with a *maximum* diameter of 29 in. Its total weight charged for action is 6,200lb., the charge consisting of 300lb. of explosive, but which can be increased to 500lb. The torpedo is self-contained—that is to say, it carries within itself its motive power, which is electricity, its propelling, steering, and manœuvering apparatus, its cable, which is payed out as it travels, and its charge. It is cigar-shaped, and when moving in the water, which it does at about 6 ft. below surface, nothing is seen of it but a couple of floats whereby its position is indicated to those who are controlling its movements. It carries 120 storage cells, developing 18 H.P. The motor weighs 780lb. and is driven at 1,100 revolutions per minute. The electric cable is three-cord and 3,000 yards long, but 4,000 yards or even more can be carried. The weapon is driven by a screw propeller and steered by a balanced rudder, the speed being 14½ knots.

The advantage this weapon possesses over most other controlled torpedoes is that when once charged it does not require a prepared base to operate from, but may be taken anywhere. It may be towed out by a small boat to any required position, started and steered so as to strike any vessel within its range, which latter simply depends upon the length of the electric cable carried by the torpedo. When once charged it is ready for use and will remain so for a very long period without re-charging. The present torpedo is intended for harbour and coast defence, and at the trial on June 15th, it was started from an old vessel as a platform, from the deck of which it was operated by a keyboard. Some distance from the platform a pair of red flags were flying on two poles placed 50 ft. apart, and about half a mile lower down the river were two more flags similarly placed. The torpedo was started and passed centrally between the first pair of flags, continuing onwards at an estimated speed of 14 knots to the second pair, between which it passed in perfect central line and beyond which it ran for some distance. It was then stopped and reversed, and a similar run back was made in excellent style and at a good speed. A third run out was made with similar results, the torpedo having travelled nearly two miles, thus exhausting her cable. It had been intended to show the manœuvring powers of the weapon, but owing to the proximity of several moored vessels and the frequent passing of others it was not possible to carry out this part of the programme. Sufficient however, was shown to demonstrate the running powers of the torpedo and the perfect control of the operator over it, the results being considered by those present to be highly successful. Mr. Nordenfelt has in hand another of these torpedoes which will carry 180 storage cells, developing 34 H.P. and giving a speed of 16 knots at 1,500 revolutions per minute.

HER MAJESTY'S SHIP "ORLANDO."

A PARLIAMENTARY PAPER is issued giving the principal particulars of the original legend of Her Majesty's ship *Orlando*, when the design was completed, compared with the corresponding particulars of the vessel as finished, with explanations of the changes; and the authority therefor. The particulars are set forth in the following table:—

—	As Designed.	As Completed.	Date of Authority for Additions to the Designs, &c.
Dimensions, &c.:—	Ft. In.	Ft. In.	
Length between perpendiculars	300 0	300 0	—
Breadth, extreme	56 0	56 0	—
Load draught of water:—			
Forward...	19 6	21 0	—
Aft	22 6	24 0	—
Mean	21 0	22 6	—
Displacement, tons	*5,040	*5,535	—
I.H.P. of engines	†8,500	8,620	—
Full speed, knots per hour ...	18	18½	—
Height of armour above load water-line	Ft. in. 1 6	Nil; the upper edge of armour is just level with the water-line.	
Depth of armour below load water-line	4 0	Ft. In. 5 6	—
Coals:—			
Complement at above load draught	†440 tons	750 tons	January, 1887.
Corresponding radius of action at 10 knots	4,400 knots	7,000 knots	—
Capacity of bunkers in tons	900 tons	900 tons	
Armament	No. In. 2 9·2 (18-ton) guns 10 6 (4½-ton) guns 6 6-pr. quick-firing guns 10 1 (Nordenfelt) Boat and field guns Torpedoes	No. In. 2 9·2 (22-ton) guns 10 6 (5-ton) guns 6 6-pr. quick-firing guns 10 3-pr. quick-firing guns Boat, field, and small machine guns Torpedoes	— — — — — —
Complement of officers and men	350	455	March, 1886, & Nov., 1887.
Weights:—			
Water and tanks...			
Provisions, with tare			
Officers' stores and slops ...			
Officers, men, and effects ...	Tons.	Tons.	Nov., 1887.
Masts, spars, and rigging ...	365	394	
Anchors and Cables			
Boats			
Warrant officers' stores ...			
Guns, carriages and slides, powder, projectiles, torpedoes, electrical stores, &c.	350	430	Various dates from Sept., 1885.
Machinery, propelling	800	795	—
Engines for electric lighting, capstan, steering, torpedoes, &c.	15 No electric light included.	34 Electric light included.	Oct., 1886.
Engineers' stores...	45	37	—
Coals	440	750	—
Conning tower	80	80	—
Director tower	—	5	—
Hull and armour	2,945	(a) 3,010	—
Total, tons	5,010	5,535	

* The displacements are for the ship as laid off.

† The design upon which tenders were invited specified compound engines of 7,500 I.H.P., with 500 tons of coal, altered in accepting tender to triple expansion engines with 440 tons of coal.

(a) Includes weight due to the adopton of central powder hoist arrangements, electric lighting, bridge, increased accommodation for largely augmented crew, davits, skid beams, and other fittings for additional boats, and increased thickness of armour at ends of belt.

Admiralty, April 29th, 1888.

SHIPBUILDING AT BARROW.—A contract has just been concluded between the Pacific Steam Navigation Company and the Naval Construction and Armaments Company, of Barrow, under which the latter company are to build for the former two large steamers of great power and speed for their line to the West Coast of South America, via the Straits of Magellan. These steamers are to be 430 ft. long, 49 ft. broad, and 37 feet deep, and are expected to attain a speed of about 16 knots.

THE "VULCAN" TORPEDO DEPOT SHIP.

ON June 18th the keel plate and portions of the vertical keel (3½ ft. high) of the *Vulcan*, torpedo depot ship and torpedo-boat carrier, were laid down at Portsmouth. The *Vulcan* is an outgrowth of the *Hecla*, and her design, which has taken two years to perfect, was one of two novelties which Lord George Hamilton had to submit to the House of Commons in his last statement. The *Hecla*, which carries only second-class torpedo craft, has a displacement of 6,400 tons, whereas the new depot ship, which will carry larger torpedo-boats, is to have a displacement of 6,620 tons. This increase of bulk is obtained by means of greater beam. The *Vulcan* will be 350 ft. in length, 58 ft. in breadth, and have a mean load draught of 22 ft. In actual weight of hull she will reach 3,170 tons. Her steaming capacity will enable her to keep pace with the quickest ships in the service. The *Hecla* has a speed of 11½ knots, but the *Vulcan* is designed for a speed of 20 knots on the measured mile, or of 18 knots continuous steaming at sea. The contract for the machinery has been allotted to Messrs. Humphrys & Tennant. Her armament will consist of eight 36-pounder and twelve 3-pounder quick-firing guns, and in addition she will be fitted with from four to six torpedo tubes. In the official memorandum the *Vulcan* is described as a swift protected cruiser, lightly armed, with a large coal endurance, and specially provided with appliances for lifting and carrying a considerable number of the largest type of second-class torpedo-boats. In addition, she will be equipped with laboratory, workshop, and a large supply of torpedoes, stores, submarine mines, and electrical appliances of all kinds. Besides being capable of protecting herself against all except the largest classes of cruisers, her speed will exceed that of most cruisers and all armoured vessels. The protective steel deck will extend throughout the length, and over machinery, boilers, &c., and will have a *maximum* thickness of 5 in., and a *minimum* of 2½ in. The Navy Estimates afford no clue as to her cost, but during the present year it is proposed to expend £132,754 upon her construction, of which £56,804 is for contract work.

THE "COUREUR."

ON June 13th there was successfully launched from the yard of Messrs. Thornycroft & Co., at Chiswick, a new torpedo boat which the firm have built for the French Government. This vessel, which is named the *Coureur*, is a twin-screw first-class torpedo boat, very similar in design to the *Ariete*, built by Messrs. Thornycroft for the Spanish Government last year, which attained on the official measured mile trial on the Thames, with a load of 17·35 tons on board, the remarkable speed of 26½ knots. The *Coureur* is 147 ft. 6in. in length, with a beam of 14 ft. 6 in. and a draught, when loaded, of 5 ft. The hull is constructed of galvanised steel throughout, and is divided into numerous water-tight compartments, which are fitted with steam ejectors for keeping them clear of water should the hull be damaged either by a collision or by projectiles. Any two of these compartments can be filled with water without rendering the boat liable to sink. She is fitted with engines of the usual direct-acting compound surface-condensing type by Messrs. Thornycroft. Their collective power at full speed is about 1,550 I.H.P., divided pretty equally between the two pairs of engines. The machinery is so arranged as to give ample space in the engine room, an important feature in torpedo boats. Steam is supplied by two of Messrs. Thornycroft's tubulous boilers at pressures ranging up to 200lb. per square inch. This system of boilers insures immunity from leakage and priming, advantages which it is very difficult to secure in ordinary boilers. The Thornycroft boiler is lighter than those of the locomotive type and takes up less space lengthwise in the boat than does the latter. So far it has proved thoroughly efficient in use and Messrs. Thornycroft are now fitting it in all their torpedo boats. The *Coureur* is steered with Thornycroft's double rudders, one on either side of the screw propellers, by means of which excellent manœuvring power is obtained. The torpedo armament consists of two tubes built in the bow of the boat for discharging Whitehead torpedoes by means of gunpowder impulse. Besides these the vessel carries four 1·85 in. Hotchkiss guns, two being fixed on the conning towers—one on each—and two being mounted on deck for broadside fire. The boat is fitted with masts and sails, a Normandy's fresh water condenser, and all the latest improvements. She has also an electric light installation for lighting the interior of the boat. Upon the occasion of the launch there were present the French Ambassador and Madame Waddington, the Count and Countess Florian, Captain Roustan (French Naval Attaché), Colonel Massing (French Military Attaché), M. Blanchard de Farges (Consul General), M. J. Perrette, and others. The christening ceremony was performed by Madame Waddington, who dashed the conventional bottle of wine against the bows of the vessel, at the same time naming her the *Coureur*. Straightway the ship glided smoothly down her ways into the Thames, amid the hearty cheers of those assembled. After partaking of light refreshments in a pavilion on the river bank, the visitors boarded the vessel and made a personal inspection of her. The French Government officials expressed their satisfaction with the craft.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from May 25th to June 23rd, 1888:—

Ash, Harold E. H., assistant engineer (lent), to date from June 20th.
Baldwin, Henry St. C., assistant engineer to the *Benbow*, to date June 14th.
Burstow, Hugh, staff engineer to the *Excellent*, additional, to date June 9th.
Cox, Herbert B. T., assistant engineer (lent), to date from June 20th.
Darley, Arthur C., acting assistant engineer (lent), to date from June 20th.
Davis, William H., staff engineer to the *Benbow*, to date June 14th.
Flood, Frederick J., engineer, to date June 20th.
Gallery, Edward, engineer to the *Benbow*, to date June 14th.
Hart, Alfred, assistant engineer (lent), to date from June 20th.
Harvey, John R., fleet engineer, to date from June 20th.
Ireland, Joseph H. H., assistant engineer (lent), to date from June 20th.
Jacobs, Frederick G., assistant engineer to the *Benbow*, to date June 14th.
Johnson, John E., engineer to the *Benbow*, to date June 14th.
Meadus, Wm. H., assistant engineer (lent), to date from June 20th.
Mitchell, Frederick, engineer to the *Osprey*.
Mitchell, William H., chief engineer to the *Excellent*, to date June 9th.
Murray, John A., engineer (lent), to date from June 20th.
Newton, George S., staff engineer to the *Excellent*, additional, to date June 9th.
Pamphlett, William F., engineer to the *Boadicea*.
Ramsey, William, fleet engineer, to date from June 20th.
Rolle, Absalom R., assistant engineer (lent), to date from June 20th.
Saywell, L. C., assistant engineer to the *Asia*, additional, to date June 4th.
Shawyer, James A., fleet engineer to the *President*, additional, to date June 9th.
Shoolbread, Adam, staff engineer, to date from June 20th.
Siddom, William, chief engineer to the *Pembroke*, additional, to date June 11th.
Stanamore, Henry C., staff engineer to the *Excellent*, additional.
Thomas, Elijah, engineer to the *Pembroke*, for service in the *Research*, to date June 15th.
Tilbrook, Charles F. H., engineer, to date from June 20th.
French, Richard J., chief engineer to the *Asia*, for the *Thunderer*, to date July 1st.
Turner, John E., fleet engineer to the *Asia*, additional, to date June 9th.
Uffindell, James E., fleet engineer to the *Serapis*, additional, to date June 9th.
Walker, James J., acting chief engineer to the *Grappler*, temporarily, to date April 2nd.
Watson, James H., assistant engineer (lent), to date from June 20th.

RAPID PASSAGE.—Messrs. Donald Currie & Co.'s steamer *Grantully Castle*, with mails and passengers from East Africa, Natal, and the Cape, which reached Plymouth at 4.15 p.m. on Sunday, June 10th, after a rapid passage from Table Bay (steaming time 17 days 12 hours) arrived at Gravesend on the afternoon of June 11th, thus reaching London within 19 days of her departure from Cape Town.

THE SHIPBUILDING TRADE.

THE monthly report of Mr. R. Knight, the general secretary to the United Society of Boiler Makers and Iron Shipbuilders, says:—During the past month we have been caused no little trouble and anxiety through our members seeking to recoup themselves of some portion of the wages that were taken from them during the recent depression. We do not find fault with them for doing this, but, on the contrary, commend them for it; and we are willing to assist them to recover lost ground. The shipbuilding trade is much better now than it has been for some time past, and this fact has caused our members to seek advances. It may be true that certain firms have taken orders at a low rate, but the men ought not to suffer for this foolish competition amongst shipbuilders. They are the first to know when orders are plentiful, and on this knowledge they should act by making provision in their estimates for increased cost of labour, as they must know that workmen will seek to get back reductions taken from them as soon as the volume of trade warrants it. We are convinced, from many years' experience, that low prices for ships do not benefit any one, and the only way to secure better prices for shipbuilders is to force them up by seeking advances in wages; but this must be done by degrees, and, when a favourable turn in trade takes place, moderation should be observed. We do not like fighting, and shall do our utmost, consistent with the society's best interest, to avoid this. If force of circumstances compels us to enter on a conflict, we shall do our best to win, but a strike should never be resorted to unless in very extreme cases. It is very necessary, so as to prevent any misunderstanding on the part of our members, that they should possess accurate knowledge of the rules of our society and the regulations laid down for its government, especially respecting disputes. The Executive Council, whoever they may be, are the general trustees of the society, into whose hands, and under whose control, the funds of the society are invested for the benefit of all its members. When the question of advance of wages or reductions has to be dealt with, affecting any branch or district, the Council are the ones to whom such matters have to be referred, as laid down in rules; and if the members affected want the Council to grant them the benefit of the society's funds, the Council are the only authority to say, when terms of settlement are offered, whether such terms are acceptable or not, taking into account at the time the general state of trade throughout the country, and the varied interests of all the society's members for whom they are trustees. If, after considering all these matters, the Council decides that in their judgment the terms offered for a settlement are acceptable, they cannot grant the use of the society's funds when members want to push them beyond that point. If members refuse to accept the Council's ruling, they then act as private individuals, and do so on their own responsibility. The Clyde report is not quite so cheerful as last month, judging from the number of orders booked, but the work on hand is good—viz., 92 vessels, with an aggregate of 184,000 tons, and more orders are in the market.

CARDIFF.—No further advance has been established in steam coal, but the high rates recently quoted have been maintained. Bituminous coal has risen 6d. per ton. Best steam coal has made 10s. 3d. to 10s. 6d.; good dry coal, 9s. to 9s. 3d.; and inferior qualities, 8s 6d. to 8s. 9d. per ton. Patent fuel has been in moderate demand; the best brands have made 8s. 6d. per ton. The local iron and steel works are pretty well employed, but at low rates. Heavy section steel rails have made £3 17s. 6d. to £4 2s. 6d., and light section steel rails, £4 12s. 6d. to £5 5s. per ton. Spanish iron ore has been in good demand.

MESSRS. FLEMING & FERGUSON, shipbuilders, Paisley, have received an order for a steel screw steamer for the China trade, through Messrs. Russel & Spence, engineers, Glasgow. She is to have accommodation for about 30 first-class passengers, and is to be fitted by the builders with their improved balanced quadruple engines to indicate about 1800 H.P.

DURING the year 1887, 18,051 applications were made for patents in the United Kingdom, of which 53 per cent. were proceeded with. For the protection of designs 26,043 applications were made.

ANGIER BROTHERS' STEAM FREIGHT REPORT, JUNE 23rd, 1888.

FREIGHTS during the past fortnight have ruled very quiet in all the homeward trades, but for outward cargoes good rates are paying in most directions. In China and Japan coasting and cross voyages offer good employment, but rates to Europe are kept unprecedentedly low, through the feud between the "Lines" engaged. India rates have shown no sign of improvement, beyond a temporary demand for prompt tonnage from Bombay, and August-September loading from Java. For cross voyages the demand is slow, but rates are maintained. From the Azoff, Black Sea, and Danube, business has materially fallen off for all dates, and the decline in rates for early loading amounts to 20 per cent. from the highest, for autumn owners wisely refrain from pressing tonnage on the market, which prevents a fall in rates. Prospects continue good for the new crops. Mediterranean rates are easier, with a poor demand for tonnage. Baltic business is less profitable, freights having fallen both for wood and grain. From America there is nothing doing, North or South. The West India trade is equally dull. Outward freights are well supported in all directions except the Mediterranean. In ship and engine building work is fairly steady, the disputes between labour and capital are settling up under the reasonable spirit of compromise shown on both sides. Fresh orders are described as "dropping in" at most yards, but not sufficient to keep them at full work, nor cause much increase in prices.

INDUSTRIAL NOTES.

THE CLYDE AND EAST OF SCOTLAND.

THE lull in the shipbuilding trade on the Clyde, which has characterised almost the whole of the first half of the year, shows signs of giving way before a fresh impetus. More than one firm on the upper reaches of the river have during the past two or three weeks booked several important orders, and inquiries are still coming in for new vessels, and the re-engining of old. Whether the movement will continue, or prove evanescent, remains to be seen, but from the slight rise in freights, which has taken place within the last month, there is at least the hope that several good orders may be booked, sufficient to help the trade through the winter. It is understood that the most important of the contracts fixed and pending are for petroleum tank steamers of special design and construction, and of great strength. The size will be considerably larger, and the speed much greater, than has hitherto been aimed at in vessels designed for carrying oil in bulk. These steamers are for the Anglo-American Oil Company, London; the English connection of the Standard Oil Company of the United States. The only order as yet announced, however, in this connection is for a steel screw steamer of 3,250 tons, to be built by Messrs. D. J. Dunlop & Co., Port Glasgow. This vessel will be 330 ft. long, 42 ft. broad, and 28½ ft. deep, and will thus be the largest vessel that has been specially built for the oil trade. Her engines will be triple-expansion on the most recent and approved principle, and she will be fitted with the electric light throughout. It is also rumoured that Messrs. A. & J. Inglis, Pointhouse, have secured a contract for a steamer of similar size and type.

The other principal contracts secured are for two twin-screw steamers, of large tonnage, to be built by Messrs. Russell & Co., Port Glasgow, and engined by Messrs. Rankin & Blackmore, Greenock, for the Amazon Steam Navigation Company; a large steel steamer of over 3,000 tons gross, and fitted with a set of triple-expansion engines, contracted for by Messrs. Alex. Stephen and Sons, Pointhouse, for Messrs. Burrell & Sons, Glasgow; and a large screw steamer to be built and engined by Messrs. Fleming & Fergusson, Paisley, for a firm in Singapore. The length of this vessel is to be 276 ft., with 36 ft. beam, and the engines are to indicate 1,800 H.P. The steamer will be used for trading and general purposes in China, and will have accommodation for thirty first-class passengers. Messrs. A. McMillan & Son, Dockyard, Dumbarton, have secured an order to build a small-sized steel screw steamer for foreign owners, and it is understood that Messrs. R. Napier & Sons, Govan, and the Fairfield Shipbuilding Company have each booked an order for a screw steamer of moderate dimensions The last-named firm have at present only

one vessel on the stocks: their large yard—which has building space for twelve vessels—having thus a most barren appearance.

The most remarkable vessel which has left the Clyde during June is the new Channel mail packet *Princesse Henriette*, built and engined for the Belgian Government by Messrs. W. Denny & Brothers, Dumbarton. On her trial trip, on June 15th, the measured mile was accomplished at the rate of 21·1 knots per hour, or six-tenths of a knot above the guaranteed speed; and on June 21st, the run from Ostend to Dover was made in two hours fifty minutes, by far the shortest passage on record, and an hour and fifty minutes under the time occupied by the steamer presently performing the regular service.

Messrs. Denny & Brothers are otherwise fully occupied with new work, their most important contracts being a repeat of the vessel above referred to; also two large and powerful mail and passenger steamships for the Compania Trasatlantica of Spain; and a steamer of large tonnage for the British India Steam Navigation Company. Messrs. Denny & Co., who engine all their vessels, are in consequence also busy. Besides the engines for new vessels, they are presently engaged upon the work of converting the engines of the large steamer *Martaban* from the ordinary compound to the quadruple-expansion type. The *Martaban* is the third steamer belonging to Messrs. P. Henderson & Co., upon which Denny Brothers have effected similar alterations and improvements, the other two being the *Tenasserim* and the *Irrawaddy*.

The sum subscribed up to date for the memorial to the late Mr. William Denny, of Dumbarton, amounts to over £5,000. The intentions of the committee in charge of this fund are not yet definitely fixed, but the general disposition seems to be to employ it in erecting a Denny memorial institution in Dumbarton, devoted to educational and recreative purposes.

Messrs. J. & G. Thomson, of Clyde Bank, are putting the finishing touches to the huge mail and passenger steamship *City of New York* for the Inman and International Company's Atlantic service, and it is anticipated that the vessel will be thrown open for public inspection before she leaves the Clyde. The firm are also making steady progress with the sister ship, and great interest is evinced in the forthcoming trial of speed of the new "ocean racers" by all connected with the shipbuilding and shipping industries.

Many of the Clyde river steamers have been overhauled of late, both in machinery and boilers, the *Lancelot*, *Benmore*, and *Meg Merrilies* having had new "haystack" boilers placed in them. The new boiler fitted in the last named is said to be the largest of the kind yet made, being 15 ft. high, with a similar width, while the pressure is 50 lbs. to the square inch. The new steamer for the Loch Lomond Steamboat Company is being built by Messrs. Napier, Shanks & Bell, Yoker. The *Fusilier*, a splendid new steamer for the "Royal Route" service conducted by Mr. David Macbrayne's fleet, is about to commence running. She has been built by Messrs. McArthur, of Paisley, and engined by Messrs. Hutson & Corbett, Kelvinhaugh, who have also fitted the new machinery on board several other river boats.

The strike of riveters employed by Messrs. Caird & Co., Greenock, was brought to an end about the 15th of the month. The demand, which was for a 10 per cent. advance all over, was made about ten weeks ago, the men having been out since then. Several meetings took place recently between Messrs. Caird & Co. and a deputation from the trade society, the result of which has been that an amicable settlement has been arrived at, according to which the riveters, with a few modifications, received what they asked for.

At Aberdeen shipbuilding matters are quiet; but Messrs. Hall, Russell & Co. have lately received an order from the Aberdeen Steamship Company (Limited) for a steel screw steamer to carry about 2,800 tons, and to be fitted with triple-expansion engines of 200 H.P.

A new bolt and rivet works is in course of erection near Coatbridge. The proprietor is Mr. Kennedy Airdrie, and when finished the work will give employment to a large number of men.

One of the most remarkable occurrences in the way of steamship collisions took place on the Clyde on the 16th June. The paddle steamer *Princess of Wales*, a new vessel built by Messrs. Barclay, Curle & Co. for the Southampton and Isle of Wight Royal Mail Steam Packet Company, was run into and cut completely in two abaft the paddle box by the *Balmoral Castle*, a large steamer previously belonging to Messrs. Donald Currie & Co. The occurrence was the more remarkable on account of its taking place while both vessels were on trial upon the measured mile off Skelmorlie during fine clear weather and in smooth water. Both portions of the unfortunate paddle steamer ultimately sank in 20 fathoms of water, and three lives were lost, while considerable trouble was experienced in rescuing others. All efforts to raise the wreck have been abandoned by the underwriters.

The *Balmoral Castle* when docked was found to have sustained damage to one plate only below water, and that on the port bow. Above water three plates on the port bow were damaged, and one on the starboard bow.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—The trade disputes which, a month ago, were causing so much inconvenience to shipbuilders have fortunately been settled, and, so far as the industry of shipbuilding is concerned, peaceable relations between employers and employed are assured for at least the remainder of the present year. An advance of 5 per cent. in wages has been conceded to the various sections of operatives, to commence with the first "pay" in August, and it may be stated that this is practically the same settlement as was made a few days earlier with the operatives on the Tees. Though peace reigns once more in the shipbuilding trade this is unfortunately not the case in the engineering industry, the fitters and other workmen in the Mid-Tyne establishments being out on strike for an advance of 2s. per week on the present wages rate. At the time of writing, however, negotiations for a settlement are in progress, and it is confidently hoped that the ordinary course of business will be shortly resumed. Messrs. Armstrong, Mitchell & Co. have commenced the construction of a second large oil-carrying steamer at their Elswick yard, and it is stated on apparently good authority that the firm have also a foreign cruiser of more than ordinary dimensions to put down. At their Low Walker establishment the whole of the berths are now occupied, and the activity existing has never been exceeded at any former period. Messrs. Hawthorn, Leslie & Co., launched during the month a splendid steamer named the *Alberto*. The vessel, which has a dead-weight carrying capacity of 5,000 tons and is elaborately fitted in all respects, has been built to the order of a local firm. The whole of the four large steamers ordered for the Gulf Line some months ago are now in progress of building, and two of them will be fit for launching at an early date. At Messrs. R. Stephenson & Co.'s yard two composite light ships, which are being built to the order of the Trinity House, are in advanced stages, and there are also three large cargo steamers on the stocks. Messrs. Swan & Hunter have launched a vessel during the month, and have now four berths occupied with vessels of large size. The Tyne Shipbuilding Company will shortly launch a very finely finished steamer—the first of two ordered by an important local company—and the firm is energetically proceeding with the construction of three other vessels. Since the termination of the helpers' strike, a couple of weeks ago, every possible effort has been made at both Messrs. Palmer's yards, to make up for the time lost, and in the short time indicated the contracts in hand have, without question, been wonderfully advanced. It is understood that the firm have secured some new contracts since the settlement of the wages question. The other shipbuilding yards on the river are generally busy, and in most repairing establishments business keeps good. The engineering establishments that are not affected by the present dispute remain as busy as possible, and the stoppage allowed for the "race holidays" was unusually short, extending only from the 19th to the 21st inst. Messrs. Henry Watson & Sons, High Bridge, Newcastle, have obtained some good Government contracts lately for specialities required in the fitting-out and equipment of war vessels, and the firm have also secured some foreign orders for their improved paper making plant. Messrs. Black & Hawthorn are now very busy in their marine department, as well as in their locomotive shops, and at Messrs. Abbot's establishment a steady business is being done. Among the most important contracts executed in the ironfoundry department of this firm during the past few months has been a number of immense columns required in the construction of the new Scotia Engine Works (Messrs. William Allan & Co.), Sunderland. The Elswick Ordnance Works are daily becoming busier, and night shifts are again being put on in shops where they had been discontinued. Continual additions are also being made to the complements of hands in the different departments. At the Newburn Steel Works orders for the various specialities manufactured there are very numerous, and undiminished briskness is the feature in all departments. Mr. George Tyzack,

South Shields, has received during the month a great number of orders from both home and foreign sources for his patent stockless anchors, and the manufacturers (Messrs. J. Abbot & Co., Gateshead,) have put up in their anchor shop a powerful new steam hammer by Davis & Primrose, of Leith, for the special purpose of making the heavier anchors of this well-known type.

The Wear.—Messrs. J. L. Thompson & Sons launched on the 23rd inst. a vessel named the *Enterprise*, which has been built to the order of a Whitby firm. This is the seventh vessel put off the stocks this year by this enterprising firm, and as all the vessels launched were of large tonnage, the total may be approximately stated at something over 20,000 tons. It may be confidently predicted that this firm will stand very nearly at the top of the list in the matter of output for the current year. Messrs. R. Thompson and Sons have received the frame material for a steamer to be built off the same lines as the *Dunfermline*, an exceptionally fine vessel which was launched a month ago. It is understood that the firm have also an order for two oil ships. The locally owned steamer *Ours* is being repaired and coated with Bruce's "Nomos" composition in the Bridge Dock. The whole of Mr. Laing's building berths are now occupied, most of the vessels being of exceptionally large tonnage. This builder has also a number of repair contracts to proceed with. Important extensions are being carried out in connection with the brass and copper works connected with this establishment. Messrs. Pickersgill have booked an order or two since last month, and it is said that Messrs. Osborne & Graham have also secured contracts. The splendid vessel which was sold by Messrs. Doxford to the British India Steam Navigation Company a few months ago, is still lying beside the yard, and engaging the services of a host of men in carrying out the extensive alterations stipulated for by the purchasers. Messrs. Short Bros. launched two large vessels at the end of May, and have now another nearly ready for putting off. Keels are being placed on the berths as soon as they are rendered vacant. The Strand Shipbuilding Company have one large vessel on the stocks, and are extensively repairing the steamer *Achilles* in the North Dock. Messrs. Blumer, Messrs. Bartram & Haswell, and Messrs. Austin have each two vessels building, while the Sunderland Shipbuilding Company have three vessels on the stocks, and have the frame material in the yard for two others. The larger engineering establishments remain very busy, and in each case new orders have been booked within the month. Mr. A. A. Rickaby has been exceedingly busy lately, having had a heavy repair contract to deal with, in addition to numerous orders for pistons and piston rod packing. Messrs. C. & M. Douglas have also been doing well, and at the Pier Engine Works the course of business has been steady. Messrs. John Lynn & Co., Pallion, have still a pressure of work in their shops, and at Messrs. Irving and Jopling's boiler works orders for water tanks, stationary boilers, &c., have for some time past been plentiful. Messrs. Thompson's (J. L. & Sons) new forge, Pallion, may now be considered complete in all its appointments, a fitting shop having been added, in which all the work required to complete stern frames, &c., after forging, can be promptly executed. At the Wear Forge Company's establishment a new steam hammer (Davis & Primrose's make) has been put up for the special work of welding stern frames. There has been much talk lately of the prospective re-opening (at an early date) of the Castletown Ironworks, not for the manufacture of iron, however, but of steel. Up to the present nothing of a tangible nature has been done in the direction indicated, but it is probable that in next month's report a definite statement may be furnished respecting the contemplated changes. In the meantime business continues steadily to improve at the Monkwearmouth Ironworks (Messrs. S. Tyzack & Co.'s), and the rolled sections patented by Messrs. Bell & Rockliff are now being manufactured on a very extensive scale.

The Hartlepools.—Very exceptional briskness is still to be noted in connection with the shipbuilding industry at this centre, and though operations were stopped for a few days owing to the existence of a wages dispute, a very large amount of work has been got through during the month. The marine engineering establishments are also very actively employed, and the same may be said of forges and ironworks.

The Tees.—The shipbuilding yard at Stockton, which was formerly occupied by Messrs. Pearse & Co., but which was closed for some time, has just been re-opened by a newly constituted firm, and is likely to become very busy in the near future. The other principal yards at Stockton and Middlesbrough are quite full of work. Steel works are pressed with orders, and the ironworks are generally much busier than they were in the early part of the year.

THE MERSEY.

THERE is a total dearth of new work on the Mersey. What few orders are still in hand are rapidly approaching completion, and there seems to be a bad look out for the shipbuilding yards in the near future. It certainly seems strange that the large shipping companies belonging to Liverpool should have to pass their own doors with their business, and at considerable inconvenience to themselves, build their vessels at other centres, when the stocks of the shipbuilding establishments on their own river are almost entirely untenanted. But so it is. The Pacific Steam Navigation Company of Liverpool have just contracted with the Naval Construction and Armament Company, of Barrow (late the Barrow Shipbuilding Company, Limited), for the construction of two large steamers for their West Coast line. These steamers, although not so fine as the two lately constructed by the Barrow Shipbuilding Company for the Pacific Company for their Australian line, viz., the *Orizaba* and the *Oroya*, will still be of large dimensions, the length of each being 430 ft., the width 49 ft., and the depth 37 ft. They are to have exceptional cabin accommodation, and are expected to surpass any steamers now in the South American trade. They are to be fitted with triple-expansion engines of great power, and it is understood that a speed of 16 knots per hour has been guaranteed. This, we believe, is the first contract of any note that the reconstructed Barrow Shipbuilding Company has secured.

Messrs. Royden & Son launched on the 23rd June a large steamer for the general trade. This vessel has been built for Messrs. Royden's own account, and is a sister-ship to the *India* now trading under their flag.

Whilst shipbuilders are generally dull, engine makers are busy, and it seems that the fitting yards are likely to have a good time for some considerable period. The engineers are not dependent on new work for their business, the recognised success of the triple-expansion engines having necessitated many owners to re-engine their steamers. Messrs. David Rollo & Sons have just fitted the steamer *Zanela* with new triple-expansion engines and boilers of 150 lb. pressure. The trial trip was most satisfactory, and a mean speed of 11½ knots was attained. The *Zanela* belongs to Messrs. John Glynn & Son, of Liverpool, and is employed in their Mediterranean line. There is undoubtedly a lull in the building trade, but it is comforting to learn that the number of steamers laying-up has been materially reduced; indeed, any boat of fairly modern construction can now be profitably employed. Shipowners generally seem to have profited by the lesson that the late severe depression in the shipping trade was expected to teach, and whilst all round we hear of old steamers being tripled, there is evidently no intention of building new tonnage to any material extent. If this policy be maintained there will be undoubtedly good times in store for steamship owners.

The freight market continues in a fairly healthy state, outward rates to the East being exceptionally high. With 23s. to Bombay, 24s. to Colombo, and other outward freights in proportion, there seems no reason to fear unprofitable voyages. Homeward business from the East is, however, not so remunerative, especially from India, and it seems as though the prospects of any improvement for this year must be abandoned. The causes for this unhappy state of affairs are not difficult to find, the internecine conflicts of the competing lines being a great factor in the low rates that have ruled for some years past; and until the millennium of peace—we were going to say of common sense—arrives, we are afraid no permanent improvement can be expected. Another contributing element in the unfortunate condition of affairs now existing, is the very large carrying capacity of some of the steamers recently constructed. A vessel lifting between 5,000 and 6,000 tons of cargo, arriving unfixed at Bombay, constitutes at once a damper for the whole freight market, especially when, as at present, from a cause to which we will refer, cargo is comparatively deficient. An abnormally large cargo boat is by no means an unmixed blessing, either to the owner of the vessel or trade in general. It frequently happens that to ensure a full cargo a very material reduction in the rate of freight has to be made, to the general injury of all concerned. Our wheat supplies, which for some years past, and in a growing extent, were largely drawn from India, have recently been received from Russia, and thus a large source for cargo has suddenly been stopped, so that the liners could easily carry all the cargo that has to be removed. When on the top of the scarcity of freightage the 5,000 tonner arrives, the position can be at once realised.

Black Sea freights have not been quite so firm during the past month, but an improvement is expected; indeed, for August when the new crop comes in, good rates are now offering.

The autumn season from America has started fairly well, and we have heard of several fixtures from Galveston at 45s. per nett register ton. This is not bad business, and there seems to be no reason why these figures should not be maintained right through the season, especially as shipowners are not evincing any undue anxiety to fix ahead.

LAUNCHES AND TRIAL TRIPS.

Launches—English.

Alberta.—On May 24th Messrs. R. & W. Hawth rn, Le lie, & Co., Limited, Newcastle-on-Tyne, launched from their shipyard at Hebburn, a cargo-carrying screw steamer for Liverpool, of the following dimensions:—350 ft. in length, by 42 ft. beam, by 27½ ft. depth of hold. Her engines, which are from the company's engine works at St. Peter's, are of the triple-expansion type, and capable of driving the vessel, with 5,000 tons deadweight cargo on board, at the rate of over 10 knots. The vessel is built of steel to Lloyd's highest class, and throughout is replete with all the most approved appliances for loading and discharging. Her steering gear is M'Ginnis' patent—one of the latest type. Donkey boilers are supplied in duplicate of the Cestus patent. Baxter's patent independent steam windlass, Harness' patent stockless anchors, and Clarke, Chapman's winches are also fitted. The christening ceremony was performed by Mrs. Howard Pease, of Pendower, the vessel being named *Alberta*.

Northcote.—On May 26th Messrs. Thomas Turnbull & Son launched from their shipbuilding premises, Whitehall, Whitby, a screw steamer constructed of steel, and as she left the ways she was christened the *Northcote*. Her dimensions are as follows:—Length over all, 298 ft. 9 in.; length between perpendiculars, 288 ft.; breadth, 38 ft. 2 in.; depth to top of floor plate, 20 ft. 11 in. She is classed A 1 at Lloyd's, and her deadweight carrying capacity is estimated at 3,440 tons. Her engines are of 195 H.P. nominal, and are constructed by Messrs. Blair & Co., Stockton-on-Tees. She is fitted with Emerson, Walker & Co.'s patent windlass. The new steamer has been built to the order of Messrs. Turnbull, Scott & Co., London.

Kathleen.—On May 26th Messrs. Osbourne, Graham & Co., of Hylton, near Sunderland, launched a 100 A1 steel screw steamer, which has recently been purchased by Messrs. Pyman, Bell & Co., of Newcastle-upon-Tyne. Her dimensions are:—Length between perpendiculars, 258 ft.; breadth, extreme, 37 ft.; depth, moulded, 19 ft.; and she has a short full poop, raised quarter-deck, bridge-house over engine and boiler space, top-gallant forecastle and cellular double bottom throughout for ballast. She will be fitted with tri-compound engines of 850 N.I.H.P. by Mr. George Clark, of Sunderland, four steam winches with donkey boiler, and the usual complete outfit for a modern cargo steamer.

Oswestry.—On May 26th Messrs. Edward Withy & Co., of West Hartlepool, launched from their shipbuilding yard a fine steel screw steamer built to the order of Messrs. Sivewright, Bacon & Co., West Hartlepool, and is the lagest deadweight carrying steamer built by this firm. The veasel is a splendid type of a modern cargo-boat, and is built of Siemens-Martin steel. Her arrangements are such that she will be admirably adapted for the American, Indian, and Black Sea trades. She is over 300 ft. in length, with a large measurement capacity, and built to the highest class at Lloyd's. The ship has a long raised quarter-deck, short poop, long bridge-house and topgallant forecastle. The holds are fitted with iron grain divisions and cargo battens; and for extra strength, and in order that she may be economically kept up, all decks, deck erections, skylights, bulwarks, bulkheads, &c., are built of steel or iron. In the main and after holds she is built on the web frame system, which gives a very strong type of ship, and dispenses with all hold beams, thus enabling the vessel to carry cargoes of the most bulky description. She has a cellular bottom all fore and aft (Withy & Sivewright's patent), and the after peak will also be available for water-ballast. To minimise the corrosion which is known to take place from the oxidisation of the mill scale adhering to the steel plates, the whole of the ship has been washed before painting by the acid process as carried out by the Admiralty. Nearly all the shell plates are in 24 ft. lengths, making the structure of the ship very strong. The vessel will be fitted with four steam winches, two donkey boilers, steam steering gear amidships, screw gear aft, direct steam windlass on forecastle, and patent stockless anchors hauling up into hawse-pipes, thus dispensing with the old-fashioned and cumbersome method of catting and fishing the anchors. The saloon for the use of the passengers, captain and officers, is finished in p lished hardwood Elegantly painted panels, executed in oils in the most pleasing and effective style, are ranged on each side of the saloon, the design and execution being by the decorative staff of ladies employed by the firm. The ship will be rigged as a two-masted fore and aft schooner, with square sail on the foremast, and iron lower masts. She will be fitted with triple-expansion engines by Messrs. T. Richardson and Sons, Hartlepool, whose type of engines has proved so satisfactory and economical in their working. The vessel has been built under the personal superintendence of Captain Bacon, who will command the vessel when ready for sea. On leaving the ways the vessel was gracefully christened *Oswestry* by Mrs. Charles Gibson Smith, of Wakefield.

Seamew.—On May 26th there was launched from the Jarrow yard of Palmer's Shipbuilding and Iron Company, Limited, a passenger steamer of the following dimensions and particulars:—Length between perpendiculars, 260 ft.; breadth, moulded, 36 ft. 6 in.; depth, moulded, 19 ft. 7 in.; depth of hold, 18 ft. 6 in. She is built of steel, to take the highest class in Lloyd's Register. There is accommodation for 100 first-class passengers, 60 second-class passengers, and 33 steerage. She is fitted with powerful cranes for the rapid loading and discharging of cargo, patent direct steam windlass by Emerson, Walker, & Thompson Bros., Limited, and all the latest improvements, including electric light throughout. The engines, also supplied by the Palmer's Company, are of the triple expansion type, having cylinders 33, 50, 76, and 45 stroke, and will steam 16 knots an hour. I.H.P., 3,500. The vessel, which has been built to the order of the General Steam Navigation Company, of London, was christened the *Seamew* as she left the ways, by Mrs. Gurney, of Gateshead.

Sultana.—On May 26th the Blyth Shipbuilding Company, Limited, of Blyth, launched a screw steamer, named the *Sultana*. This vessel has been built to the order of Messrs. Bailey and Leetham, of Hull. Her leading particulars are as follows:—Length, 265 ft.; beam, 36 ft.; and depth, 23 ft.; built on the three-deck rule to secure Lloyd's highest registration. The m in and upper decks are of iron, and there are six compartments formed by iron bulkheads extending from the keel to the upper deck, four large cargo hatches, and ample water ballast arrangement. The main cabins are under the full poop, and consist of saloon, berths for captain and 12 passengers, &c. Officers and engineers are provided with cabins under the long bridge amidships. The poop, bridge, and forecastle are connected by gangways. Four steam winches will be fitted for working cargo; Amos & Smith's steam steering gear is on the bridge; Emerson & Walker's patent windlass on forecastle deck; engines tri-compound with cylinders 23 in., 36 in., and 60 in. diameter are being made by the owners Messrs. Bailey & Leetham, Humber Iron Works, Hull, where the vessel will be shortly towed to have engines, boilers, and winches put on board. Both the ship and her machinery have been constructed under the superintendence of Mr. Thomas Thompson, the owners' managing engineer. The ceremony of naming the *Sultana* was performed by Mrs. Thomas Thompson, of Hull.

Goole No. 7.—On May 28th, there was launched from the yard of Mr. J. T. Eltringham, South Shields, an iron screw tug, 100 ft. by 19·6 by 11·9 moulded, to class 100 A at Lloyd's. The arrangements of the vessel throughout are of the most modern and approved type for sea-towing, and include steam windlass and steam steering gear. The engines, of 75 N.H.P., are on the triple-compound principle, having cylinders 14 in., 22 in., and 36 in. diameter, with 24 in. stroke, steam being supplied from one large steel boiler, working at 150 lb. pressure. The vessel, which has been built to the order of Messrs. J. P. Rennoldson & Sons, of South Shields, who supply the machinery, is intended for the towing trade on the Humber and the East Coast generally, and is owned by the Goole and Hull Steam Towing Company (Limited), of Goole, to whom Messrs. Rennoldson have previously supplied several vessels. On leaving the ways she was named *Goole No. 7*, the ceremony being performed by Mrs. Ward, of Goole.

Legislator.—On May 28th the s.s. *Legislator*, which is the sixth vessel built by Messrs. Raylton, Dixon & Co. for Messrs. Thomas & James Harrison, of Liverpool, was launched from the yard of her builders. She is a spar-deck steamer, built of steel, intended for the Calcutta trade, and of the following dimensions:—Length over all, 342 ft. 3 in.; breadth, 40 ft.; depth, moulded, 29 ft. 2 in.; and has a deadweight carrying capacity of about 4,100 tons, with Lloyd's free-board. She has hoods over steering

gear aft, with long deck-house, in which is a very handsomely fitted saloon and accommodation for passengers, and is fitted throughout in every way as a first-class steamer for this special trade. She is fitted with powerful direct-acting steam windlass, Emerson, Walker & Co.'s patent, and carries Wastney Smith's stockless anchors stowed up hawse pipes. She will be fitted with engines by George Clark, Esq., of Sunderland, on the triple-expansion principle of 250 N.H.P., having cylinders 24 in., 40 in., and 66 in. by 48 in. length of stroke. On leaving the ways she was christened the *Legislator* by Miss Brown, of Coatham.

Asiatic Prince.—On May 29th Messrs. Short Brothers launched from their shipbuilding yard at Pallion, Sunderland, a steamer built to the order of Messrs. James Knott and partners, of Newcastle-on-Tyne, of the following dimensions:—Length, 290 ft.; breadth, 39 ft.; and depth, 21 ft. 2 in. The vessel is constructed under special survey to the highest class of steel in Lloyd's Registry, and is built on the cellular double-bottom principle for water-ballast all fore and aft, and web frames, dispensing with hold beams. There is a short full poop aft for the accommodation of the captain and officers, long raised quarterdeck between the poop and bridge, the latter extending before the foremast, with accommodation for the engineers at the after end, and the crew in the fore end. She has open shelter forecastle, which is connected to the bridge with a gangway. There are four large hatchways with a powerful steam winch at each, with donkey boiler fitted on deck; steam steering-gear amidships, patent windlass by Emerson Walker & Co., and all the latest improvements. On leaving the ways the vessel was named the *Asiatic Prince*, the ceremony being performed by Miss Daisy Teale, of Scarborough. The engines, which are to be fitted by Mr. John Dickinson, of Sunderland, are of 200 H.P., on the triple-expansion principle, having two steel boilers of 150 lb. working pressure, with all the latest improvements in marine engineering.

Gotha.—On May 30th Messrs. Earle's Shipbuilding and Engineering Company, Limited, launched from their yard at Hull the fine screw steamship *Gotha*, which they have constructed for the Yorkshire Coal and Steamship Company, Limited, of Goole, for their general trade between the latter port and the Continent. As the description given below will show, this steamer is designed and her cargo appliances arranged in the best method to suit the traffic she will be engaged in. Her length is 220 ft., breadth 29 ft., and depth 13 ft. 6 in., and she is built of steel to Lloyd's highest class with top-gallant forecastle, bridge, and poop, a considerable portion of the two latter being available as shelter for deck cargo and cattle, and water ballast is provided in the main and after holds. Amidships under the bridge accommodation is fitted for 14 passengers, with a comfortable saloon, ladies' cabin, and state rooms, the entrance to this being in a house overhead, which also contains a compartment for the steam-steering gear supplied by the Harrison Steering Engine Company. The captain and officers are berthed aft under the poop, and the crew forward in the forecastle. It is intended to rig the vessel as a schooner with two pole masts, and when completed she will present a smart appearance on the water. The hatches, winches, &c., are carefully arranged to afford the greatest possible facility for working the cargo. The machinery has also been made by Earle's Company, and consists of a set of triple-compound 3-crank engines, with cylinders 20½ in., 31 in., and 54 in. diameter, each having a stroke of 33 in., and a powerful double-ended boiler made in accordance with Lloyd's and Board of Trade rules for a working pressure of 165 lbs. per square inch, and fitted with Henderson's patent self-cleaning firebars. The ship has been built on fine lines, and it is expected that the above engines will propel her at such a rate as to make her one of the fastest vessels trading to the Humber Ports.

Callisto.—On June 9th, at the Pallion yard of Messrs. Wm. Doxford & Sons, Sunderland, the screw-steamer *Callisto*, built to the order of Messrs. Pinkney, Sons & Clare, of London, for general trading, was launched. Her dimensions are 250 ft. by 36 ft. by 18½ ft. She carries 2,400 tons deadweight all told, and is fitted with triple-expansion engines, also by William Doxford & Sons, with cylinders 18, 29, 48, and 33, and large boilers. She is built of steel, with all the latest improvements, including lap jointing of shell under water and patent direct-acting steam windlass by Emerson, Walker & Co. The *Callisto* has been sold by Messrs. Pinkney, Sons & Clare to Messrs. Hudig and Veder, of Rotterdam. She was named by Miss Nellie Pinkney, of Sunderland.

Gellivara.—On June 9th the twin screw steamer *Gellivara*, built by Messrs. C. S. Swann & Hunter, of Wallsend, left her moorings at that place and proceeded down stream. The *Gellivara* is a passenger and cargo steamer, having saloon amidships, and electric light installation throughout. The vessel is owned by the Anglo-Scandinavian Company, and is the first of a proposed line of steamers intended to open the mineral wealth of the far north. The sailing capabilities of the *Gellivara* will be tested over the trial trip course off Tynemouth, after which the vessel will proceed to Middlesbrough, at which a cargo of rails will be shipped for Lulea, to which place she will shortly proceed on her maiden voyage. The engines of the *Gellivara* were built by the Wallsend Slipway Company.

Jane Jolliffe.—On June 12th Messrs. J. Readhead & Co., West Docks, South Shields, launched a steel screw steamer intended for towing purposes, of the following dimensions, viz.:—130 ft. by 22 ft. 6 in. by 12 ft. 6 in., and to be fitted with triple-expansion engines with cylinders 16 in., 26 in., 43 in., and 30 in. stroke, to work at a pressure of 160 lb. This steamer has been built to the order of Mr. T. A. Jolliffe, of Liverpool, and was named the *Jane Jolliffe*.

Lady Brassey.—On June 13th there was launched from the yard of Messrs. H. S. Edwards & Son, Howden-on-Tyne, a pleasure-steamer named the *Lady Brassey*. Exceptional interest attaches to the vessel from the fact that she is to be fitted with an armament, and to be utilised, if necessary, for the purpose of coast defence. The Hon. T. A. Brassey had undertaken to bear the cost of fitting out the steamer so that she will be able to carry guns, the guns being provided by the Naval Volunteer Home Defence Association, with the assistance of the Admiralty. The *Lady Brassey* has been built to the order of the Hastings, St. Leonards-on-Sea, and Eastbourne Steamboat Company, which has been established with the object of providing steamboat service during the summer months from Hastings, St. Leonards, and Eastbourne piers to places along the coast, and also to ports between Dunkirk and Dieppe. The new vessel is a twin screw steamer of light draught, drawing only 6 ft. of water. The plans and specifications were prepared by Mr. Charles Blagburn, of the firm of Messrs Menzies & Blagburn, of Leadenhall Street, London, and Newcastle-on-Tyne, and the boat has been built by Messrs. Ernest Scott & Co., of the Close Works, Newcastle. She is 160 ft. long, and has a 24 ft. beam. She has two sets of triple-expansion engines with 10, 16, and 20 in. cylinders, with 18 in. stroke. The engines are necessarily not so light as those made by Messrs. Scott & Co. for the ordinary torpedo boat service, yet the weight has been kept as low as possible consistent with the strength and stability required for the every-day work which the vessel will have to do. The vessel is entirely of steel, and has water-tight bulkheads and all the latest improvements. She has been constructed to attain considerable speed, and will be capable of making 12 or 14 knots an hour on a small consumption of coal. Bunker accommodation is provided to carry sufficient coal for six days. She will be classed A 1 at Lloyd's, and will have a Board of Trade certificate for Channel service. As to the nature of her armament, we understand that definite arrangements have not been made. It is probable, however, that she will carry two or four quick-firing machine guns. A brigade is being formed in Hastings to man the vessel.

Frankfort.—On June 14th the new s.s. *Frankfort*, which has been built by Earle's Shipbuilding and Engineering Company, Limited, Hull, for the Yorkshire Coal and Steamship Company, Limited, Goole, for general cargo trade, was taken on her trial trip. She is built of iron to Lloyd's highest class, and is 240 ft. by 33 ft. by 15 ft. depth of hold, with accommodation for captain and six passengers, the officers being berthed under the bridge and crew in forecastle. Her engines, which are on the triple-compound three-crank principle, have cylinders 20·2 in., 31 in., and 54 in. diameter by 33 in. stroke, and are supplied with steam from two steel boilers made for a working pressure of 160 lbs. per square inch. After adjusting compasses the guests were conveyed on board in the builders' screw tug *Samson*, and the *Frankfort* steamed down the Humber and out to sea. The owners were represented by Messrs. A. Davy (director), Meek (manager), Kirk (secretary), Jamieson (consulting engineer), and the builders by Messrs. Pearson, Dixon, and Cole, of the managerial, engine, and ship departments respectively, besides whom there were several friends of both parties. Off Withernsea the ship was put on the measured mile, and the average of the runs showed a mean speed of close on 12½ knots at 92 revolutions; and this, taking into consideration the very light trim she was in, was thought to be an exceedingly good result. The engines worked most satisfactorily throughout, and on the return journey upwards of 100 revolutions was reached without the slightest sign of heating, and the distance between the Middle and Killingholme

Lights (7½ knots) was traversed in 30 minutes. The ship was afterwards berthed in the Alexandra Dock at Hull to take in a cargo of coals for Norrköping.

Avalon.—On June 16th there was launched from the shipbuilding yard of Messrs. C. S. Swann & Hunter, Wallsend-on-Tyne, the *Avalon*, a steel screw steamer, built for Messrs. C. T. Bowring & Co., of Liverpool. The dimensions are:—Length, 280 ft.; beam, 37 ft. 6 in.; depth moulded 21 ft. 8 in. The vessel has a long bridge amidships, and raised quarter-deck, topgallant forecastle, cellular double bottom throughout, four steam winches, steam steering gear, stockless anchors to draw into the hawse-pipes. The engines are on the triple-expansion principle, supplied by Messrs. Blair & Co., Limited, Stockton-on-Tees, and are capable of indicating about 1,100 H.P. As the vessel left the ways she was named by Mrs. Henry Bowring, of Low Fell. The *Avalon* will be classed 100 A 1 at Lloyd's, built under special survey, also under the superintendence of Captain Henry Towill, of Liverpool.

Steel Paddle Steamer.—On June 25th there was successfully launched from the shipyard of Messrs. Edward Finch & Co., Limited, of Chepstow, the splendid new steel paddle saloon steamer built by that firm to the order of Sir William Thomas Lewis, of Cardiff, for the conveyance of passengers, their luggage, and general merchandise between that port and Bristol. The vessel, which measures 170 ft. by 22 ft. by 9 ft. 6 in. is built wholly of Dowlais steel, and has a magnificent first-class saloon 44 ft long, with refreshment bar at its forward end; a spacious private saloon for ladies, and a first-class dining saloon under deck aft. Below deck forward there is a second-class dining room 27 ft. long by 22 ft. wide. On deck amidships there is a shelter house 33 ft. long by 22 ft. wide for the accommodation of steerage passengers, and also provided with suitable refreshment bar. Over this shelter house and the first-class saloon there is a splendid promenade deck just 100 ft. long. The whole of the vessel's appointments have been most carefully arranged for the comfort and convenience of passengers, and on the latest sanitary principles. She will be elegantly furnished in all compartments, and will, without doubt, be a great favourite with the inhabitants of Bristol, Cardiff, and South Wales district, and will create a diversion in the passenger traffic between the two ports. The vessel is divided into nine watertight compartments by means of extra strong bulkheads, so that she is practically unsinkable. She is being fitted with oscillating surface condensing engines of 750 H.P. effective, capable of driving the vessel at a speed of 17 miles per hour. Her boilers are of navy type, with four furnaces 3 ft. 6 in. diameter and 6 ft. long for 110 lbs. working pressure, so that this vessel's power will be greatly in excess of that of any other boat of her class at present running passengers in the Bristol Channel. She has been built under the personal superintendence of Mr. Henry Watkins Lewis, of Merthyr and Cardiff, who was on board when launched. As she left the ways she was christened by Mrs. Wm. Thos. Lewis, jun., of Abercanaid, near Merthyr.

LAUNCHES.—Scotch.

Barbaras.—On May 24th Mr. Jarvis launched from his shipbuilding yard at Anstruther a steam vessel intended for the coasting trade. She was named the *Barbaras*. Her dimensions are:—Length of keel, 85 ft.: length over all, 90 ft.; breadth of beam, 20 ft.; depth of hold, 9 ft. 1 in.; and 112 of tonnage. She is classed A1 at Lloyd's for nine years. Her machinery is to be put on board at Dundee, and the engines are to be of 25 H.P., with which she is expected to steam 8 knots an hour.

Lucy Ashton.—On May 24th there was launched at Rutherglen, from the shipbuilding yard of Messrs. T. B. Seath & Co., a passenger paddle steamer, 190 ft. long by 21 ft. by 7 ft. 3 in., intended for passenger service on the Clyde between Craigendorran, Dunoon, and other watering places. She is built to the order of the North British Steam Packet Company, and is constructed wholly of steel, with full saloon aft, and fore cabin and saloon accommodation forward. The engines are to be fitted on the most approved principle, with the view of attaining the highest possible speed, by Messrs. Hutson & Corbett, Kelvinhaugh. She was named the *Lucy Ashton*, the ceremony being performed by Miss Darling, Edinburgh.

Princess of Wales.—On May 25th, at Whiteinch, there was launched from the shipbuilding yard of Messrs. Barclay, Curle and Co., Limited, a saloon paddle steamer, built for the Southampton, Isle of Wight, and South of England Royal Mail Steam Packet Company, Limited, which will be an addition to their fleet of steamers, whose run is from Southampton to Cowes, Ryde, Portsmouth, &c. The new steamer is larger than the preceding steamers built at Whiteinch for the same owners, and fitted with many improvements, and with additional facilities for working the vessel in the shape of steam steering gear, steam windlass, after capstans, &c. Her dimensions are 215 ft. by 21 ft. and by 8.6 ft., and her engines, which are by the same builders, are of the compound diagonal type. The vessel was named the *Princess of Wales* by Miss Gilchrist, Dunoon Castle.

Ibis.—On May 26th a steel screw steamer, named the *Ibis*, was launched from Caledon Shipbuilding Yard, Dundee (Messrs. W. B. Thompson). The vessel, which is about 1,400 tons register, and is fitted with triple-expansion engines of 200 N.H.P., is of the following dimensions:—Length between perpendiculars, 250 ft.; breadth moulded, 32 ft.; depth of hold, 15 ft. 8 in. She is fitted with Higginson's steam quartermaster steering gear (combined hand and steam). The *Ibis*, which has been built in excess of the highest class at Lloyd's, is intended for the general trade of the Cork Steam Shipping Company, Limited. As usual in vessels belonging to this company, the *Ibis* has been constructed on what is known as the cellular-bottom principle.

Paris.—On June 1st the Fairfield Shipbuilding and Engineering Company, Limited launched from their yard at Govan a steel paddle steamer named the *Paris*, the second of two vessels being constructed by that firm for the London Brighton and South Coast Railway Company for their express service between Newhaven and Dieppe. As in the case of the *Rouen*, the principal dimensions of the *Paris* are as under:—Length, 250 ft.; breadth, 29 ft.; depth (moulded), 15 ft.; tonnage, 800 tons. The vessel will be fitted up for 110 first-class and 108 second-class passengers, with every convenience necessary for the Channel service. The ventilation has also been specially studied, and the vessel will be fitted with the usual steam apparatus for steering, lifting anchors, pumping, &c. A large promenade deck, extending over the engines and boilers, between the paddle boxes and extending over the deckhouse aft, will be fitted for first-class passengers. Accommodation will be provided for second-class passengers forward on the 'tween decks, and for the steerage passengers forward under the turtle back. With regard to the safety of the passengers on board, special attention has been paid to life-saving in case of emergency; a full complement of lifeboats, &c., will be fitted, besides a number of patent collapsible boats, providing ample security for the whole of the passengers. The vessel will be fitted by the builders with a set of compound diagonal and surface-condensing engines with cylinders 46 in. by 83 in. diameter and 6 ft. stroke, the steam being supplied by four single-ended multitubular boilers, with corrugated furnaces constructed of steel for a working pressure of 110 lb. per square inch. This is the ninth vessel launched by the Fairfield Shipbuilding Company for the London Brighton and South Coast Railway Company and Western Railway Company of France.

Aldborough.—On June 1st Messrs. Russell & Co., shipbuilders, launched from their Kingston yard, Port Glasgow, a steel screw steamer which has been specially constructed for the grain trade to the order of Mr. Frederick Woods, London. The new vessel is named the *Aldborough*, and is of the following dimensions:—Length over all, 286 ft.; breadth, 38 ft.; depth of hold, 20ft. 5 in.; net tonnage, 1,600 tons, with a deadweight carrying capacity of 3,600 tons. She will be fitted with a set of triple-expansion engines by Messrs. James Houdon & Co., engineers, Glasgow. She is fitted with Wastney Smith's patent stockless anchor stowed up hawse pipe. The *Aldborough* is a sister ship to the *Virginia*, built by Messrs. Russell & Co., for the same owner, and launched on March 24th last.

Tighnamard.—On June 6th S. M'Knight & Co. launched from their shipbuilding yard at Ayr a steel screw steam yacht of 210 tons, which was named *Tighnamard* by Miss Balfour, Blythswood-square, Glasgow. The dimensions are:—Length, b. p., 125 ft.; breadth, 19 ft.; depth, moulded, 10 ft. 10 in. This yacht has been built under special survey to class 100 A 1 in Lloyd's, and to the order of Messrs. John Inglis & Co., yacht agents, Glasgow, for an Ayrshire gentleman. The machinery will be supplied by William Kemp, engineer, Govan. Engines, triple-expansion; cylinders, 11, 18, and 29 in. diameter by 22 in. stroke; steel boiler, 10 ft. 3 in. diameter by 8 ft. 9 in. long, 160 lb. w. p. The *Tighnamard* will be fitted throughout with the electric light.

Glenavon.—On June 9th Messrs. Russell & Co., shipbuilders, Greenock, launched from their yard a sailing ship of 2,000 tons register, and of the following dimensions:—Length, 290 ft.; breadth, 42 ft.; and depth, 24 ft.; built to the order of Messrs. J. R. de Wolf & Co., Liverpool. The new vessel on leaving the ways was named the *Glenavon* by Mrs. James R. de Wolf, wife of the owner, and was towed to the James Watt Dock, where she will be masted and fitted out for sea.

Lindula.—On June 11th Messrs. William Denny & Brothers launched from their Leven shipyard at Dumbarton, the steel-built screw steamship *Lindula* for the British India Steam Navigation Company, Limited. The builders' dimensions, 350 by 42 by 29; gross tonnage, 3,400. The engines will be quadruple-expansion by Messrs. Denny & Co. The ceremony of naming the vessel was performed by Miss Helen Ruth Hamilton, grand-daughter of Mr. and Mrs. P. Denny, Helenslea.

Kaifong.—On June 12th Messrs. Scott & Co., shipbuilders, Greenock, launched from their yard at Cartsdyke, a twin screw steamer of 1,650 tons register, built to the order of the China Navigation Company, and intended for their China trade. On leaving the ways the vessel was named the *Kaifong*. She is to be supplied by her builders with triple-expansion engines of 1,000 H.P., and will be masted and fitted out for sea at the Victoria Harbour.

Firth of Cromarty.—On June 12th there was launched from Messrs. Russell & Co.'s Bay Street yard, at Port Glasgow, a steel sailing ship of the following dimensions:—Length, 246 ft.; breadth, 37 ft. 5 in.; depth, 21 ft. 5 in.; and about 1,445 tons net register. The new vessel is named *Firth of Cromarty*, and has been built to the order of Messrs. James Spencer & Company, Glasgow, for a general trade. She will be fitted out at Port Glasgow, and afterwards proceed to Glasgow to load for Australia.

Kobe Maru.—On June 12th the London and Glasgow Engineering and Iron Shipbuilding Company, Limited, launched from their yard at Govan a screw steamer named the *Kobe Maru*. She has been built to the highest class at Lloyd's to the order of the Nippon Yusen Kaisha of Japan, under the superintendence of Capt. A. R. Brown, managing director of the company, and is a sister ship to the *Saikio Maru*, launched from the same yard in March last. The *Kobe Maru* is intended also for the mail and passenger service, and will be furnished and equipped by the builders in the same superior manner as her duplicate just mentioned. The principal dimensions are:—Length, 325 ft.; breadth, 40 ft. 6 in.; and depth, moulded to main deck, 21 ft. 6 in. The *Kobe Maru* is the fifth vessel built by the London and Glasgow Company, under the superintendence of Captain A. R. Brown. The ceremony of naming the vessel was performed by Miss Kate Brown, Ringwood, Hampshire, sister of the managing director of the Nippon Yusen Kaisha.

Kistna.—On June 14th the Ailsa Shipbuilding Company launched from their yard at Troon the *Kistna* (s.) This vessel is built of steel, is 240 ft. by 33 ft. by 25 ft., and is moulded to shade deck. It has been built to the order of the British India Steam Navigation Company, Limited, for their Indian coasting trade. She is built under special survey at Lloyd's, will be classed 100 A1, and rigged as a schooner with two steel pole masts. She has a poop aft with accommodation for first-class passengers, bridge-house amidships, with rooms for officers and second-class passengers; and topgallant forecastle, with crew's quarters and offices for native passengers, and is fitted with steam-steering gear amidships, direct steam windlass and capstan forward, by Emerson, Walker & Thompson Bros., London; steam winches for working cargo, and all the latest improved appliances and superior finish usual to this company's steamers, and including electric light throughout the ship. The machinery, which will be fitted by Messrs. David Rowan & Son, Glasgow, will be of the triple-expansion type of large power to give a high rate of speed. As the vessel left the ways she was named the *Kistna* by Mrs. John Clark, wife of the superintending engineer of the British India Steam Navigation Company, Limited.

Leon-y-Castella.—On June 15th Messrs. David J. Dunlop and Co., shipbuilders and engineers, Inch Works, Port Glasgow, launched from their yard a steel screw steamer of 560 tons gross, and of the following dimensions:—Length, 190 ft.; breadth, 27 ft.; depth, 13 ft. The vessel is named the *Leon-y-Castella*, and will be supplied by her builders with a set of triple-expansion engines, and will be fitted throughout with the electric light. The new vessel has been built to the order of Messrs. Elder, Dempster & Co., and is a sister ship to the one which Messrs. Dunlop & Co. have at present on the stocks.

Dauntless.—On the 20th inst. Mr. John Thomson, boilermaker, Greenock, launched at the Albert Harbour a steam yacht named the *Dauntless*. This yacht formerly belonged to Lord Dunmore, but some time ago Mr. Thomson purchased her. He has now increased her length to 40 ft., giving her a new steel boiler, a new fore cabin, and a new steel stern, which, together with a complete overhaul, gives the yacht a fine appearance.

Oriole.—On June 23rd there was launched from the shipbuilding yard of Messrs. John Scott & Co., at Kinghorn, a paddle passenger steamer named the *Oriole*, built to the order of the General Steam Navigation Company, London. The dimensions are:—Length, 236 ft.; breadth, 27½ ft.; and depth, 10 ft. The vessel, which is built of mild steel throughout, is fitted up with diagonal compound engines of about 300 N.H.P., and is expected to attain a speed of twenty miles an hour. All the latest improvements have been introduced. The vessel will be engaged in the passenger traffic between London and Margate.

LAUNCH—Irish.

Ivy.—On June 19th Mr. C. F. Biggar, shipbuilder, launched from his yard at Londonderry a screw steamer, built to the order of the Glasgow, Dublin, and Londonderry Steam Packet Company (Laird's Line), managed in Glasgow. As the vessel left the ways she was named the *Ivy*, by the Duchess of Abercorn. The new vessel is 190 ft. long, 28 ft. broad, and 14 ft. 6 in. deep (moulded), and her gross tonnage is about 520. She is handsomely fitted up in every detail, and her arrangements include five collision bulkheads. The passenger accommodation makes provision for 50 first-class, and the vessel is fitted with Messrs. Anderson and Kinnell's induced draught ventilators, so that cattle may be carried in the hold, with closed hatches. The engines are of the most improved triple-expansion type, and are expected to develop 1,000 H.P., with boiler pressure of 160 lb. to the square inch. The *Ivy* has all the latest appliances, including electric lighting, steam steering gear, &c. The engineeers are Messrs. Lees, Anderson & Co., Glasgow, and the vessel will at once be towed over to the Clyde to receive her machinery.

LAUNCHES—Finnish.

Ifebe.—Length, 120 ft.; breadth, 19 ft. 6 in.; depth of hold, 9 ft. 2 in.; draft with cargo, 7 ft. for 100 passengers; built for the Finnish coasting trade, and engined with triple-expansion engines, being the first engines of this class built in Finland. The vessel is fitted with two boilers to work at a pressure of 140 lbs. per square inch, with a consumption of fuel equal to 9½ cubic feet. The calculated number of I.H.P. is 320; diameter of high pressure cylinder, 12 in.; intermediate cylinder, 17½ in.; low pressure, 24 in.; stroke in inches, 21; number of revolutions, 140 per minute. Guaranteed speed, 12 knots.

Ebba Munck.—Length, 132 ft.; breadth, 22 ft.; depth of hold, 10 ft.; draft with cargo, 8 ft. 3 in.; for carrying passengers and cargo between the port of Nystad in Finland, and Stockholm. She is engined in the same manner as the foregoing vessel. Entirely built over and fitted with Wasteneys Smith's patent anchors. Her stipulated speed is 10 knots per hour.

Relandersgrund.—A lightship of the following dimensions: Length, 89 ft.; breadth, 22 ft.; depth of hold, 10 ft. 9 in.; draft, 6 ft. 9 in.; built for the Finnish Government, and fitted with the latest improved lighting apparatus.

LAUNCH.—Danish.

Gefle.—On May 23rd the Elsinore Iron Shipbuilding and Engineering Company launched the *Gefle*, a steel screw steamer built to Veritas' first division, 180 ft. long, 26½ ft. beam, 13 ft. 7½ in. depth of hold. The vessel will carry 750 tons on 13½ ft. draught. The engines are compound surface condensing, of 480 I.H.P., and the boiler is constructed for 90 lb. working pressure. She has one of Emerson, Walker & Co.'s patent steam windlasses.

LAUNCH.—Swedish.

Vesteras.—On June 6th a new steamer was launched by the Bergsund Engineering Company, Sweden. The new boat, which was christened *Vesteras*, is intended to run between Stockholm, Torshälla, and Vesteras, and is a first-class passenger steamer built of Bessemer steel. She has a length of 117 ft., is 19 ft. broad, and 7 ft. deep when loaded. The engines are triple-expansion and of 350 I.H.P.; the contracted speed is 13 knots. The steamer is expected to be ready by midsummer.

TRIAL TRIPS.

Lady Margaret.—On May 25th the new steamer *Lady Margaret*, which has been recently purchased by Messrs. Edwards, Robertson & Co., of Cardiff, for the conveyance of passengers between Cardiff, Weston, Ilfracombe, &c., had an experimental trip for the satisfaction of the Board of Trade officials. The boat left the landing-stage at Cardiff about half-past four o'clock, and steamed across to Weston Bay, thence to Clevedon, and home. The Board of Trade officials made a thorough examination of the engines and boilers of the steamer, also the accommodation for passengers, which they thoroughly approved of. The *Lady Margaret* is licensed by the Board of Trade to carry 750 passengers, and on the trip she attained a speed of 15 knots, notwithstanding the fact that the engines had not been fully opened out. The steamer is under the command of Captain D. West, late of the old *Lady Margaret*.

Rapel.—On May 29th the steel screw steamer *Rapel*, which was launched three or four weeks ago from the Blyth Shipbuilding Company's yard at Blyth, was sent to sea for the adjustment of compasses. Several trials of speed were afterwards made on the measured mile, the results being highly satisfactory to all concerned, in spite of the unfavourable weather. After running for several hours the *Rapel* returned to Blyth Harbour to complete her loading for Valparaiso. This vessel is for the South American trade, and owned in Valparaiso, and has been constructed to the requirements of the owners' representative, Mr. Thomas Dewsbury. The *Rapel* will carry about 1,700 to 1,800 tons when loaded. The engines are of the tri-compound description, and have been put on board by the North-Eastern Engineering Company, Wallsend. Both ship and engines have been superintended by Mr. Thackrah during their construction, and the commander of the vessel is Captain Evans.

Spindrift.—On May 30th the steel screw steamer *Spindrift*, 320 ft. long, 40 ft. beam, 29 ft. deep, and of over 3,500 tons gross register, which has been built by Messrs. Russell & Co., Greenock, went down the Firth for a trial of her machinery, which has been supplied by Messrs. Dunsmure & Jackson, of Govan. The engines, which are of the triple-expansion type, have cylinders 24 in., 39 in., and 64 in. diameter, with a stroke of 45 in. Steam at a pressure of 150 lb. per square inch is supplied by two double-ended steel boilers, 12 ft. 6 in. diameter, and 15 ft. 6 in. long, each being fitted with six of Purves's patent flues as manufactured by Messrs. John Brown & Co., Sheffield. The *Spindrift*, which was originally contracted for by Mr. J. S. Barwick, Sunderland, has been purchased since by Messrs. R. C. Gilchrist & Co., Liverpool and London. She will be employed in the trade with China, and will form one of the fleet of vessels plying under the flag of the China and Japan Shippers' Union, London. During construction the hull and machinery have been under the superintendence of Mr. David Pollock, consulting naval architect and engineer, Glasgow; and she will be commanded by Captain William Hare, late of the *Guy Mannering*, another vessel of the Union fleet. The trial consisted in running the vessel continuously for five hours on a trip to Arran and back to Greenock. During the whole time of steaming, the engines and other machinery worked with the greatest smoothness and regularity, and on the return journey she went on the measured mile, attaining a speed of 12¼ knots with the engines making 84 revolutions per minute.

Tudor Prince.—On May 31st a new screw trawler named the *Tudor Prince*, built to the order of Messrs. W. H. Storey and partners, had a successful trial trip at sea. She completed the distance from the mouth of the Tyne to the mouth of the Coquet Light (20½ miles) in 2 hours 10 minutes, and returned the same distance in 2 hours 4 minutes, the engines doing their work satisfactorily. A strong westerly wind caused a heavy "lipper," but the boat was quite steady at all times. Mr. T. Eltringham, South Shields, built the hull and boiler, the machinery being the work of Messrs. Baird & Barnsley, North Shields.

Rose.—On May 31st the new screw tug the *Rose*, recently launched by S. M'Knight & Co., Ayr, for Messrs. Barnes, Guthrie, and Co., Cardiff, left Glasgow for trial of engines, which are exceptionally powerful for a tug steamer, having cylinders 29 in. and 55 in. by 36 in. stroke, steel boiler 16 ft. diameter by 11 ft. long, 80 lb. working pressure. On the measured mile in the Gareloch, and also at Skelmorlie, the vessel, with 6 ft. by the stern, and a strong gale blowing from the north-west, attained a speed of 13 knots per hour, which was considered highly satisfactory. The owner, Mr. John Guthrie, of Cardiff, and Mr. Bowyer, his consulting engineer after seeing the vessel under full steam for over four hours, expressed their entire satisfaction with the working of the engines.

Saikio Maru.—On May 31st the steamer *Saikio Maru*, the most recent addition to the fleet of the Nippon Yusen Kaisha, went on a cruise down the Firth. The weather was stormy, half a gale blowing from the north-west, but notwithstanding the vessel behaved capitally. No speed trials were made, but she steamed well, and looked as if the record would come up to the standard mentioned in the specification. The *Saikio Maru* is specially constructed for mail and passenger service, and when she leaves the Clyde in the course of a week or so she will proceed to Japan to take up her station between Yokohama and Shanghai. Her dimensions are 325 ft. long and 40 ft. 6in. wide, while the depth is 21 ft. 6 in., moulded to the main deck. While 2,240 tons of cargo will be carried on a mean depth of 20 ft. there is ample space provided for the accommodation of passengers. For 52 first saloon passengers spacious state-rooms have been fitted up. There is a very handsome dining saloon in the main deck. It extends from side to side of the vessel, and in the matter of fittings and ventilation leaves nothing to be desired. The walls are panelled in white oak, relieved with gilding and bevelled glass mirrors. A set-in sideboard occupies one end, and at the opposite end there is an open fireplace with marble mantelpiece. All through the ship there are ingenious appliances, many of which economise space and will add materially to the comfort of the passengers. As the vessel is intended to sail in a hot climate, special attention has been paid to the ventilation, the automatic principle of the Green Ventilating Co. having been applied in addition to the ordinary system. The rooms of the officers and engineers are on the shade deck. There are very good quarters for the accommodation of 24 second-class passengers and 140 emigrants, and the crew and firemen. The steamer is lighted by electricity, put in entirely by the Edison-Swan Co. It consists of a Tangye compound engine, driving an Edison-Hopkinson dynamo at 55 volts and 270 amperes, which, reckoning three-quarters of an ampere for every 16 candle-power light, would be sufficient for 360 lamps at a maximum. There are in the ship about 30 lamps of 50 candle-power each, and 270 of 16 candles. Messrs. Muir & Caldwell's steam steering-gear is applied to the rudder, the head of which is fitted with Messrs. Harland & Wolff's patent quadrant. The automatic engines are placed in the stern, and are governed by means of a rod working from the wheel amidships through a nest of bevelled wheels. This has the advantage of doing away with the rattling of steering chains. There are mechanical appliances on board for dealing quickly with cargo. The engines, which were also furnished by the builders, are of the triple-expansion inverted direct-acting type. Steam is supplied from two double and two single ended boilers, with a working pressure of 160lb. per square inch.

Rouen.—On June 2nd the steel paddle steamer *Rouen*, built and engined by the Fairfield Shipbuilding and Engineering Company for the London Brighton and South Coast Railway, to augment their Channel service between Newhaven and Dieppe, went down the Firth for an experimental cruise. The company, which included several of the directors of the above railway and representatives of the Great Western Railway of France, joined the vessel at Prince's Pier, and a run was made as far as the Cumbrae Lighthouse. The weather was very unfavourable, rain falling all day, accompanied by a strong breeze. The new vessel, however, behaved well, and during the run exceeded the contract speed of 18 knots per hour. The principal dimensions of the steamer are:—Length, 250 ft.; breadth, 29 ft.; depth (moulded), 15 ft.; tonnage, 800 tons. She will carry 110 first-class and 108 second-class passengers, with every convenience necessary for the Channel service, including electric lighting, electric bells, steam heating pipes in all saloons, cabins, &c. The ventilation has also been specially studied, and the vessel is fitted with the usual steam apparatus for steering, lifting anchors, pumping, &c. A large promenade deck extending over the engines and boilers, between the paddle-boxes, and extending over the deck-house aft, is also fitted for first-class passengers. Accommodation is provided for second-class passengers forward on the 'tween decks, and for the steerage passengers forward under the turtle back. With regard to the safety of the passengers on board, special attention has been paid to life-saving in case of emergency, a full complement of lifeboats, &c., being fitted, besides a number of patent collapsible boats, providing ample security for the whole of the passengers. The vessel is fitted with a set of compound diagonal and surface condensing engines, with cylinders 46 in. by 83 in. diameter and 6 ft. stroke, the steam being supplied by four single-

ended multitubular boilers, with corrugated furnaces constructed of steel for a working pressure of 110 lb. per square inch.

Inanda.—On June 2nd, this vessel, built by Messrs. Hall, Russell & Co., of Aberdeen, to the order of Messrs. J. T. Rennie and Sons, of London and Aberdeen, was taken for trial at sea. She is 280 ft. long, 35 ft. 5 in. beam, and 25 ft. deep, and of 1770 gross registered tons. She has been built under special survey, and carries Board of Trade and Lloyd's highest class certificates, being fitted with all the latest improvements for convenience and quick handling, and is lighted throughout with electricity, having mast-head light for illumination of the decks. She is propelled by triple-expansion engines, having cylinders 21 in., 34 in., and 56 in. diameter, with a stroke of 42 in., the working pressure being 160 lb. per square inch. The machinery was handled with the greatest promptitude and facility, and the vessel's mean speed upon trial, with about 1000 tons deadweight on board, was 12¼ knots, the engines indicating 1,450 H.P. The machinery has been built from the specification of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool, who have inspected it during construction. The vessel left Aberdeen immediately after the trial, having on board the Messrs. Rennie and several prominent shipowners and engineers.

Brenner.—On June 4th this vessel, recently launched by Messrs. Wm. Doxford & Sons, Sunderland, sailed from the Tyne with a full cargo of 2,600 tons for Savona. The day was spent in progressive trials on the mile at Whitley, when a mean speed was registered of 9 9 knots, actual. She then left on her voyage, and reached Deal in 28 hours, attaining a speed of fully ten knots. She has been built to the order of Messrs. Cay, Hall & Co., of South Shields, and was constructed under the supervision of Mr. Arthur Cay.

Benmore.—On June 6th the screw steamer *Benmore*, belonging to the Grampian Company, of Aberdeen, was taken to sea on her trial trip. The ship was fully laden, and a speed of about 10 knots was obtained on the runs over the measured mile off Whitley; and, after a successful trial, the vessel sailed for Cronstadt. The *Benmore* was constructed by Messrs. Wm. Dobson & Co., of Low Walker, and the engines were built by the North-Eastern Marine Engineering Company, at their Wallsend Works.

Tartar.—On June 6th the screw steamer *Tartar*, the largest of the Orient Line yet engined at Hartlepool, made a successful trial trip. She is a vessel of 4,339 gross tonnage, 376½ ft. between perpendiculars, 37 ft. breadth, and 30 ft. deep. Messrs. P. Richardson & Sons have just fitted her with triple-expansion engines, with 36 in., 58 in., and 94 in. cylinders, developing 4,750 I.H.P., fed by three steel boilers, with Fox's corrugated tubes, and will only consume 42 tons daily, against 63 with her old boilers, thus saving 700 tons in a trip to the Cape and back. She, in a choppy sea, steamed the measured mile at a speed of 17 knots, and gave the utmost satisfaction to her captain and engineers.

Mavis.—On June 8th the *Mavis*, the latest addition to the river fleet of the General Steam Navigation Company, made her official trip down the Thames from London Bridge to the Mouse Light and back. There was a large party aboard. The vessel was gaily bedecked with flags, and attracted not a little attention along the river. The boat, whose hull is entirely of steel, is 215 ft. long and 26 ft. beam, the gross registered tonnage being 550 tons. Her draught of water when fully laden is 5½ ft. On the return journey she came alongside of Tilbury Pier to disembark some of the visitors when there was not much more than 4 ft. of water close by the pier side. Her keel was laid in October, 1887, and she was launched on the 24th ult. from the ways at the shipbuilding yard of Scott & Co., Kirkcaldy. On the builders' trial trip on the Firth of Forth, the vessel attained a speed of 18½ statute miles an hour. She has a bar keel, and is provided with a bow rudder, so as to avoid the delay occasioned to passengers by her having to "swing" before disembarkation can be effected. The *Mavis* is the second of a series of boats which the directors of the company have ordered for the service between London and Margate and Ramsgate. The first of the new type, the *Halcyon*, has been in the service about a year. In regard to comfort and extent of accommodation, the *Mavis* is rather superior to the first of the class. The area of the fore deck appropriated to the second-class passengers has been enlarged, whilst the weather shelter built for their accommodation still remains as large. The deck saloon of the *Mavis* is of the same proportions as that of the *Halcyon*, and is furnished and fitted in a similar manner, the furniture being upholstered in russet-coloured plush. The decoration is slightly different. The ceiling is white, with panelling of French grey, and the walls are adorned with oil paintings executed on the panels with pretty effect. Special attention has been given to the ventilation of the dining saloon. An abundance of life-saving apparatus is carried on board. The *Mavis* started from Fresh Wharf, London Bridge, at 12 o'clock, and proceeded down the river to within a short distance of the Mouse Light, when she turned. She proved to be a fast and steady boat, and ran the measured mile in 3 min. 42 sec. At the luncheon Mr. Cattarns, the general manager of the company, who presided, in proposing "Prosperity to the General Steam Navigation Company," said the construction of a vessel which would meet all the requirements of the present day for the public travelling between London and Margate and Ramsgate had for a long time exercised the ingenuity of their officials, and he believed that in this vessel they had succeeded. She could travel almost regardless of wind and weather at something like 20 miles an hour.

Duke of Cornwall.—On June 9th a most interesting and instructive trial trip took place off the coast of Hartlepool. The vessel is the new steamer *Duke of Cornwall*, just completed by the well-known firm of ship-builders, Messrs. William Gray & Co., of West Hartlepool, to the order of the Truro Steamship Company, of which Messrs. J. & R. B. Chellew, of Truro, are the managing owners. This is a well-decked steamer of 270 ft. length, 36½ ft. beam, and nearly 20 ft. deep, built of steel to Lloyd's highest class, and carries 2,600 tons dead-weight. She has a raised quarter-deck, which is joined to a long bridge carried forward to the fore-hatch, containing comfortable quarters for the crew. There is a poop aft, with saloon and cabins for the officers and a few passengers, the engineers being housed beneath the bridge deck near the engine-room. The vessel is replete with every facility that modern shipbuilding science has devised for economising labour in the navigation of the ship, and in the loading and discharging of cargo. The old-fashioned system of cross-beams in the holds has been discarded, and the newer "web frame" principle adopted, which leaves a clear way for dealing with cargo and removes all obstructions to quick despatch. There are no less than five hatches, and four steam winches, thus further adding to the capacity of the vessel for rapid loading and unloading. All the deck machinery is arranged to be driven by steam from a large donkey boiler, placed below near the main boilers. The vessel is built on the "double bottom" principle, the space between forming the capacious water-ballast tanks. The main engines are of the triple expansion type, and are supplied by the Central Marine Engineering Co., of West Hartlepool. They are driven by steam of 150 lbs. pressure generated by two extra large steel boilers. A visit into the engine-room of this steamer in company of a suitable guide will readily convince every engineer that neither care nor expense has been spared to make the machinery, and the thousand-and-one accessories thereto, as perfect as possible. The *Duke of Cornwall* received her finishing touches from the builders late last week, and had completed the receipt of her first cargo, which including bunkers weighed 2,613 tons, draught of water 18 ft. 8½ in., by Friday night, June 8th. At three o'clock on Saturday morning, June 9th, she proceeded to sea, the weather being calm, sea smooth, but much tendency to fog. The first few hours at sea were spent in the adjustment of compasses, Mr. Berry performing this important task, and which resulted in finding them almost precisely accurate. This done, the vessel was brought up to the measured mile, it being the intention of those in charge to spend the greater part of the day in making a series of careful trials of speed at various horsepowers over the mile, the ship being in full loaded trim. The first mile north and the mile return south were run in splendid style, with the engines throttled up to 65 revolutions per minute, the north mile being completed in exactly 6 minutes, giving 10 knots per hour with tide in favour of ship, and the south mile going 8·1 knots against an increasing tide, making an average of 9·05 knots per hour for the first trial, with engines at the speed named. Almost immediately this run was completed a dense fog came up, causing the necessity of dropping the anchor and remaining at rest for three hours. On the fog partially lifting it was seen to be clearest seaward, and improbable that the mile posts on land would be seen again that day. It was therefore decided to test the full power speed of the ship by means of the patent log, and accordingly the vessel was headed due east, the engines opened full out, the revolutions being 74 per minute, and at the end of an hour the log recorded a little over 10 knots accomplished. The vessel was then brought round, and the westward run made under same conditions, the log recording a little under 10 knots, the course being nearly across the tide, thus showing practically a full power speed of 10 knots average in smooth water. This speed quite outstripped the

expectations of both builders and owners, and as the machinery ran without any water at all being used on the bearings, and without the slightest hitch or stoppage of any kind occurring, it goes without saying that the trial was regarded by all as of the most highly satisfactory character throughout, and the mutual congratulations expressed were of the pleasantest possible character. The owners were represented at the trial by Captain Chellew, and the builders and engineers by Mr. Mudd, the manager of the Central Engine Works.

Henry.—On June 9th the steamer *Henry*, of Liverpool, 1550 tons dead-weight capacity, and belonging to Messrs. Curwen Bros., of Liverpool, for whom Messrs. Westgarth, English, & Co., of Middlesbrough, recently contracted to fit her with completely new triple expansion engines, went on a trial trip. Considerable improvements and alterations to the ship have been carried out by Messrs. R. Craggs & Son, of Middlesbrough, and both the ship and engine work have been done under the superintendence of Mr. W. C. Lang, of Liverpool. The engines have cylinders 15 in., 23½ in., and 39 in., by 33 in. stroke. The vessel was in ballast trim, and made a speed of 10¾ knots.

Zancla.—On June 9th the s.s. *Zancla*, one of the steamers belonging to Messrs. John Glynn & Son's Mediterranean fleet, went on her official trial trip, leaving the Wellington Dock at 10·30 a.m., with the owners and a party of friends on board. The machinery of this vessel has been converted from compound to triple-expansion, and a new high-pressure boiler fitted. The design is such as to admit of the three cranks and three new cylinders being carried on the old framing and bed-plate without any extension whatever in the length of these parts. Her high-pressure cylinder is 19 in. diameter, intermediate 30 in. diameter, and low-pressure 49 in. diameter, with a stroke of 33 in. common to all. She has one large single-ended steel boiler 15 ft. 3 in. diameter, by 10 ft. long, having four of Brown's patent ribbed furnaces 3 ft. 2 in. inside diameter, the whole constructed to Lloyd's requirements for a working pressure of 150 lb. per square inch. The vessel steamed from Liverpool to Llandudno, the engines running smoothly at 78 revolutions per minute, and indicating 770 H.P., vessel going a speed of 11¼ knots per hour. Everybody on board expressed themselves highly satisfied with the vessel's performance. The whole of the contract was carried out by Messrs. David Rollo & Sons, Engineers, of this city, and is the second vessel belonging to this Company which they have converted on these lines. The work was superintended by Mr. George Hepburn, the company's consulting engineer. At Llandudno the party disembarked, and the vessel proceeded direct to sea, calling at Cardiff, from which port she will sail, taking her usual station on the Mediterranean trade.

Othon Stathatos.—On June 11th the new steel screw steamer *Othon Stathatos*, built by Messrs. John Readhead & Co., West Docks, South Shields, was taken to sea on her trial trip. The vessel's dimensions are 270 ft. by 36 ft. 9 in. by 18 ft. 9 in., of the improved well-decked type, and built to class 100 A1 at Lloyd's under special survey. The engines, also built by Messrs. John Readhead & Co., are on the triple-expansion principle, and on the trial indicated 1,200 H.P. Several runs were made along the coast and on the measured mile, the mean speed being 11½ knots per hour. The trial proved very satisfactory, both to owners and builders. The vessel has been built to the order of Messrs. Stathatos Brothers, of Braila and Sulina.

Lundy.—On June 12th the screw steamer *Lundy*, a new vessel, 260 feet long, 37 ft. broad, and 29 ft. deep, which Messrs. Richardson, Duck & Co., of Stockton, have built for Messrs. Groves & Co., of London, had her trial trip from the Tees to the Tyne. The vessel has engines on the triple-expansion type of 150 H.P.N., with cylinders 21, 34, and 56 in. in diameter, by 36 in. stroke, and working at a pressure of 160 lb. The engines are by Messrs. Blair & Co., Limited, of Stockton. The vessel made a most successful run, her speed being nearly 11 knots an hour.

Garland.—On June 13th the splendid new auxiliary steam yacht, built for the Hon. Mrs. Elliot Yorke by Messrs. Ramage and Ferguson, Leith, left the Firth of Forth for the south of England. Built of steel to the highest class in Lloyd's Yacht Register, and heavily rigged as a two-masted topsail schooner, the *Garland* presents a most able and seaworthy appearance. Her dimensions are:—Length, B P. 124 ft.; breadth, moulded, 21ft. 6in.; depth, moulded, 13 ft. 6in.; while the engines are triple-expansion with Messrs. Ramage & Ferguson's new valve gear for economising fore and aft space, the cylinders being 11½ in., 18½ in., and 30 in. in diameter by 20 in. stroke, supplied with steam from a steel boiler working up to 150 lbs. pressure per square inch, having two of Brown's patent annular ribbed furnaces. On the trial trip under steam the high mean speed of 10¾ knots per hour was attained on the measured mile, the engines working almost noiselessly, and developing 280 H.P. The accommodation is very spacious. She is commanded by Captain Darby, and will no doubt attract considerable attention from yachtsmen on her arrival in the Solent.

Rangoon.—On June 13th the trawling steamship *Rangoon* left Hull for the purpose of running her trial trip. The *Rangoon* is a screw steamer 100 ft. long, 20½ ft. broad, and 11 ft. deep. She is 110 tons gross, and 64 tons net register, and she has been built to the order of Mr. George Beeching, of Hull, and Mr. Thomas Kelsall, of Manchester. The contract for the building of the *Rangoon* was undertaken by Messrs. C. D. Holmes & Co., of Hull, but Messrs. Cook, Welton & Gemmell built the hull, Messrs. Holmes constructing the engines. These are of 45 H.P.N. They are surface-condensing, having cylinders of 17 and 33 in. in diameter, with 22 in. stroke. The boiler is a large one, and has a working pressure of 90 lb. to the square inch. At the trial very good progress was made down the Humber, upon leaving which the vessel's head was turned towards Withernsea, where the mile was run twice, the first time in 5 min. 32 sec. with the wind and tide in favour of the vessel, and the second in 7 min. The former gave a speed of 10·81 knots per hour and the second 8·50 knots per hour, an average time of 6 min. 16 sec. and 9·65 knots in speed. The *Rangoon's* head was then turned to the eastward, and a due east course was steered for about 50 miles, and then at 7 o'clock in the evening the trawl was lowered. Trawling was continued until midnight, when it was hauled up and found to contain 11 baskets of fish, consisting of turbot, soles, lemon soles, cod, codling, whiting, gurnets, crabs, plaice, and haddocks. After the trawling operations were concluded, the ship returned to Hull.

Frankfort.—On June 14th the new steamer *Frankfort* was taken on her trial trip. She has been built by Messrs. Earle's Shipbuilding and Engineering Company, Limited, of Hull, for the Yorkshire Coal and Steamship Company, Limited, of Goole, for general cargo trade, and is 240 ft. long, by 33 ft. beam, by 15 ft. depth of hold, her engines being on the triple-expansion principle, with three cylinders and three cranks. On leaving Messrs. Earle's yard the compasses were adjusted, and the ship was steamed down the river, the weather being beautifully fine. When the *Frankfort* arrived off Withernsea the vessel was put on the measured mile, and the average of the runs showed a mean speed of nearly 12¼ knots, which was thought to be a good result. The engines worked satisfactorily throughout, and upwards of 100 revolutions were reached without the slightest sign of heating. On the return journey the time occupied between the Middle Lightship and Killingholme, a distance of 7½ knots, was 30 minutes, or a speed of 15 knots per hour. When the *Frankfort* arrived at Hull she was placed in the Alexandra Dock to take in a cargo of coals for Norrköping.

Princess Henriette.—On June 15th the paddle steamer *Princess Henriette*, lately launched by Messrs. William Denny and Bros., of Leven Shipyard, Dumbarton, for the Belgian Government, was tried officially, and satisfactory results were obtained. The trials consisted of four consecutive runs, two each way, between the Cloch and Cumbrae Lights, two with the tide and two against, the total distance being about the same as that between Ostend and Dover, in which service this vessel will run. The actual mean speed realised at this trial was 21·1 knots, or six-tenths of a knot over the guaranteed speed. The dimensions of the vessel are 300 ft. in length by 38 ft. beam by 13 ft. 6 in. depth moulded. To enable her to leave the harbour without the necessity of canting inside, she has been made, as in the case of the *Victoria* and *Empress*, built for the London Chatham and Dover Railway, double-bowed, with a rudder forward.

Magada.—On June 19th the screw steamer *Magada* had her trial trip from West Hartlepool. The vessel, which has been built by Messrs. William Gray & Co., of West Hartlepool, to the order of Mr. Otto Trechmann, of the same town, is 290 ft. long, 38 ft. broad, and 21 ft. deep. She has been furnished by Messrs. Blair & Co. (Limited). of Stockton-on-Tees, with engines on the triple expansion principle, the cylinders being 22½ in., 36½ in., and 60 in. respectively, by 39 in. stroke, and working at 160 lb. pressure of steam. The trial trip was of a most successful character, everything working in first-class style. The vessel attained a speed of between 9 and 10 knots an hour.

Drumburlie.—On June 20th the new steamer *Drumburlie*, built by Messrs. Robert Thompson & Sons, of Sunderland, to the order of Messrs. Gillison & Chadwick, of Liverpool, was taken on her trial trip. Her dimensions are:—Length, 305 ft.; breadth, 39 ft. 8 in.; depth of hold, 25 ft. The vessel is classed 100 A1 at Lloyd's, and has a deadweight capacity of nearly 4,000 tons. The engines, which were supplied by the North-Eastern Marine Engineering Company (Limited), of Sunderland, have cylinders 23½ in., 38 in., and 62 in. diameter, with a stroke of 42 in. There are two double-ended boilers of large size. On the trial trip the engines ran exceedingly well, but owing to the unfavourable weather it was not possible to take runs on the measured mile. Both the vessel and her machinery were built under the superintendence of Messrs. Flannery & Blakiston, of Liverpool, and the vessel will shortly proceed to Bombay, under the command of Captain Chubb.

Dotterel.—On June 21st the Cork Steamship Company's steamer *Dotterel* left the Nelson Pierhead at 11 o'clock and proceeded down the river on her official trial trip, after having her machinery converted to triple-expansion and being fitted with new boilers. Her cylinders now are 20 in., 32 in., and 52 in. diameter respectively, with a stroke of 36 in. common to all three. There are two boilers, each of 12 ft. 6 in. diameter by 9 ft. 6 in. long, constructed to Lloyd's requirements for a working pressure of 150 lbs. per square inch, having three of Brown's patent ribbed furnaces 3 ft. 11 in. diameter in each boiler. The engines ran very smoothly at 74 revolutions, and indicated 875 H.P. The averaged speed of the vessel was 11 knots an hour. Besides the alterations to the machinery, the vessel's hull has had a thorough overhaul and been covered in aft. The entire work has been carried out by Messrs. David Rollo & Sons, engineers, of this city, under the directions of Mr. Kelson, the company's engineer, and Captain Croft, the marine superintendent. All on board the *Dotterel* expressed themselves highly satisfied with the vessel's performance under her altered conditions. The improvements have resulted in a considerable reduction in the consumption of fuel, and a very appreciable increase of speed.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

THE MARINE ENGINEERS' UNION.

To the Editor of The Marine Engineer.

Sir,—On reading the letter of Mr. F. Seaton Snowdon, in the June issue, I was very much surprised at the disparaging remarks used towards Marine Chief Engineers. (As I do not belong to the above Union, therefore can write with impartiality, so far as the Union is concerned.) From the tone of Mr. Snowdon's letter, he seems to insinuate that all chief engineers required cramming, which is far from the truth, and would lead many who do not know to the contrary to look on sea-going chief engineers as usurping a position they had no right to. I certainly admit many of them require information, no matter how highly educated they may be, as to the method of obtaining a B. T. certificate, which those in charge of the so-called cramming schools can and do enlighten them, the fee required being so small as to be within the reach of any ordinary engineer. I do not for one moment uphold the coaching system as understood, but any sensible engineer knows that a man obtaining his certificate by those means alone, is of little use when left in charge.

Further, as to the Marine Engineers' Union developing into a Trades Union, as it is put, even though it came to this at the worst, it would not be a very great catastrophe, as then the members would be certainly a highly educated body, which the highest authorities admit would be a blessing, their only objection to Trades Unions being the illiterate portion being led to do things that, if their knowledge had been greater, would refrain from many strikes, &c., which has been to the mutual disadvantage of all concerned. This objection is a very small straw to clutch at, and to use it to condemn what is apparently a society for the protection of sea-going engineers.

His controversion with regard to Mr. Leak's statement seems very tame—"That Marine Engineers in many instances have 'built' the engines they take charge of." I take this statement to mean that there are chief engineers, who have taken charge of the engines in the erecting &c.—not one pair alone—and previously have designed them or similar in the drawing office.

I could mention the names of at least a dozen of chief engineers, sailing out of London who are capable of doing this, and at same time can bear favourable comparison with many of those who have a lot of letters to their names. As for reading papers, I think it would be very wrong to enlighten people of a certain class with their hard-earned experience, only to be snubbed for their pains.

As to chief engineers of over twelve months' standing not having taken part in the construction of triple-expansion engines, I fail to see that an engineer is any the less capable for not having (actually) taken part in the construction of a triple-expansion engine any more than if he had not taken part in the design, &c., of a patent valve gear or an injector. But I assert fearlessly, there are many chief engineers sailing who could design a triple-expansion engine, construct, take them to sea, and work them, returning to vindicate and support their less fortunate brethren to maintain their proper position, &c. As I feel sure that the time has come when we each and all who call ourselves engineers should be in earnest to assist the natural law, viz., "The survival of the fittest to the suppression of the weakest." Fittest in our education, engineering ability, gentlemanly conduct, as engineer officers, coupled with good practical knowledge, and always willing to take our coat off and bend to the most menial job in the engine room or elsewhere when the necessity of the case requires it, or don our white shirt and kids and meet on an equality with the respected officers in the other department, and above all things, never to allow the most junior of engineers to be on an equality with firemen, although always respecting these latter in their own sphere, not forgetting that they are men as we ourselves.

Then, Sir, why, as engineers, should we run down those in our profession in the face of our common enemy? Rather let us point out to one another where improvement might be made, and let us exercise a generous spirit and give a little credit even to the worst amongst us down to the old-fashioned certificated engineers, who may not even be able, some of them, to write their own names, but many of whose qualities and practical ideas would put to shame a number of the brightest amongst us, and not forgetting that they at least assisted in developing the marine engine of the nineteenth century.

With apologies for again asking you to insert a Marine Chief Engineer's opinion,

I am, Sir,
Yours truly,
EXPERIENCE.

To the Editor of The Marine Engineer.

Sir,—In my last letter the printers have made an error.

I am, at line five of the sixth paragraph, made to say "(there are more," etc.), whereas I wrote ("there are none," etc.).

Your kind attention will oblige.

I am, Sir, yours obediently,
F. SEATON SNOWDON.

June 23rd, 1888.

Miscellaneous.

Messrs. J. F. Waddington & Co., of Seacombe, Liverpool, have secured the contract for building a large stern-wheel steamer, about 170 ft. long by 25 ft. beam, having three decks and passenger accommodation both for saloon and steerage. She will be fitted by the same builders with compound engines, to give a speed of 11 knots. This vessel will, we believe, be the first light-draft stern-wheel steamer to make an ocean voyage to her destination abroad on her own bottom from the river Mersey.

THE LONDON AND NORTH WESTERN SCOTCH EXPRESS.—In an editorial note in our last issue we briefly referred to the acceleration of the traffic between Glasgow and London and *vice versa*, and its beneficial effects on the numbers attending the Exhibition, and we now have to chronicle the fact that the London and North Western Scotch Express is doing the journey in one hour's less time than previously taken, and it is interesting to note that the gain in time is made up entirely in speed, and not by curtailing the stoppages, and so interfering more or less with the passenger's creature comforts. The time allowed for stoppages is 47 minutes, viz.:—Willesden, 3; Rugby, 5; Crewe, 7; Preston, 25; and Carlisle, 7; leaving just 8 hours 13 minutes for the actual running of 400 miles, or an average of 48·68 miles per hour throughout. The run to Carlisle, 299½ miles, shows a still better average, being done in six hours, or at 50·05 miles per hour.

THE Council of the Society of Engineers announce that Mr. C. J. Light has been obliged to resign the positon of secretary to the Society through illness, a loss they very much regret; and that they have appointed Mr. G. A. Pryce Cuxson, A.R.I.B.A., as secretary.

MESSRS. EDWARDS & SYMES.—We have received from this old-established and well-known firm of engineers and shipbuilders an official notification of their removal from Cubitt Town to much larger and more convenient premises at Millwall, situated near the North Greenwich Station. The firm will have increased facilities in their new premises for executing all orders with the greatest despatch, and we trust that in their new location they may continue to receive the same generous measure of support which has been accorded them heretofore.

OILING THE SEA.—An improved method of distributing oil on the waters has been patented in Germany. It consist of a rocket to which is attached a cylinder filled with oil. It is said that the rocket can be fired with accuracy from the ship, and that, when it explodes, the oil is scattered just where it is wanted. Several interesting experiments have recently been made between Bremen and New York. In one the rocket was fired to a distance of 1,500 ft. and less distances. By the explosion of five rockets at a distance of from 1,200 to 1,500 ft. from the ship, a space of 1,500 to 2,000 square feet of water was covered with oil, and the waves were at once smoothed. The rocket was fired 900 ft. against a gale. The importance of the invention to deep-water sailors consists in the certainty of explosion of the rocket at a sufficient distance to leave the vessel in calm water during a gale.

THE officers of the Union S.S. Company's steamer *Mararoa* gave their half-yearly dinner in April last at the Provincial Hotel, Port Chalmers. Mr. Cameron (the chief officer) was in the chair, and Mr. M'Caig (chief engineer) was croupier. In addition to the officers of the vessel there were several visitors present, and a very pleasant evening was spent. Miss Cash, the hostess of the Provincial Hotel, provided an excellent dinner, to which all present did ample justice. After the cloth was cleared the Chairman, proposing the usual loyal toasts, called upon all present to unite with him in wishing happiness and prosperity to Mr. James Mills, M.H.R., the managing director of the company. This toast was drunk with musical honours. The other toasts proposed were: "Captain Cameron, the marine superintendent of the company;" "Captain Edie, the commander;" "The Chief Engineer, Mr. M'Caig;" "The Officers;" "The Hostess;" and "The Press." During the course of the evening a number of excellent songs were rendered, and a very pleasant time spent.

A CORRESPONDENT of the *Times* writes:—The *Thunderer*, double turret ship, after a general inspection, is to be supplied at Portsmouth with new engines and boilers. The work will be performed by contract. The *Glatton*, coast defence vessel, is also to be supplied with a new set of boilers. It is probable that, owing to want of foresight, these formidable ironclads will be lost to the service of the country for a year or more. As their machinery was known for a long time previous to be worn out, the exercise of a little foresight on the part of our naval administrators would have arranged matters so as to have the new engines and boilers ready to lift on board immediately on the ships paying off. As it is the turret vessels will have to rust in the basin until the engines and boilers are manufactured. It is to be hoped that the *Téméraire* will not have to wait in a similar way for her boilers.

THE INSTITUTION OF NAVAL ARCHITECTS.—A meeting of the Local Reception Committee was held last month in the rooms of the Institution of Engineers and Shipbuilders in Scotland, 207, Bath-street, Glasgow, when various preliminary arrangements were considered in view of the approaching visit of the Institution of Naval Architects to that city at the end of July. The meetings will extend over three days, for the reading and discussion of "papers," and the visiting of works in the afternoon. The proceedings will likely terminate by an excursion on the river and Firth of Clyde. The Reception Committee is a large and influential one, the Lord Provost having willingly agreed to assist in promoting the success of the meetings. The first summer meeting of the Institution of Naval Architects was held in Glasgow in 1877, under the presidency of the late Lord Hampton. This year they will meet under the presidency of the Earl of Ravensworth.

THE "BARRACOUTA."—Instructions were received at Sheerness Dockyard in June for preparations to be made for building a fast war cruiser of a new type, designed for the Royal Navy, by Mr. W. H. White. Director of Naval Construction. The proposed vessel is to be named the *Barracouta*, and will be built of steel, with a length of 233 ft. and a breadth of 35 ft. She will have a displacement of 1,580 tons, and is to be fitted with engines of the new triple-expansion type, estimated to develop 3,000 H.P. under forced draught, with a speed of 16·5 knots. Her armament is to consist of six 36-pounder quick-firing guns, four three-pounder ditto, and four Whitehead torpedo tubes. She is also to be mounted with Nordenfelt machine guns. Six cruisers of the *Barracouta* type are to be built for the Royal Navy during the present financial year.

FAST PASSAGE ACROSS THE ATLANTIC.—The *Etruria* reached the port of New York on Saturday morning, June 2nd, beating all previous ocean records by nearly three hours. She reached Sandy Hook at 10·45, and the passengers all landed before 3. The time from Queenstown to New York was 6 days 1 hour 55 minutes, just 2 hours 57 minutes less than the fastest previous time by the *Umbria* in May, 1887. The *Etruria* also beat the best previous single day's run, making on the fifth day out 503 knots. The average was 470 knots a day. The daily runs were:—First, 455; second, 458; third, 496; fourth, 485; fifth, 503; sixth, 457. At the start it did not appear that the elements favoured even an ordinary trip. On the second day a fresh gale was blowing from the west, the sea was choppy, at times coming over the bow. The engines were run at reduced speed for two hours. The weather, however, soon moderated, and full speed was resumed. The fast time began to be made on the third day, and still better on the fourth. On the fifth a fresh breeze was blowing, and the steamer took full advantage of it, going ahead under both steam and sail. Travel to Europe this summer promises to reach unusual dimensions.

The *Etruria's* previous records are as follows:—

WESTWARD.	D.	H.	M.	EASTWARD.	D.	H.	M.
August, 1886.....	6	5	44	August, 1885.....	6	9	11
May, 1886	6	8	20	September, 1885 ..	6	7	30
June, 1886.....	6	11	28	December, 1885 ..	6	10	30
August, 1886.....	6	10	59	May, 1886	6	11	25
February, 1887	6	7	45	February, 1887	6	5	11
				April, 1888	6	4	40

The best single day's run previously made by the *Etruria* was on her second voyage to the westward, on which occasion she steamed 481 nautical miles, which is equal to 557 statute miles, and required a speed of over twenty-three miles per hour to accomplish.

Here is the time made by the *Umbria*, sister ship to the *Etruria*, and her only rival:—

WESTWARD.	D.	H.	M.	EASTWARD.	D.	H.	M.
April, 1886.....	6	11	14	May, 1886	6	12	10
May, 1886	6	12	25	June, 1886.....	6	11	10
June, 1886	6	13	39	July, 1886.....	6	10	35
September, 1886 ..	6	7	40	December, 1886 ..	6	12	41
April, 1887	6	11	8	January, 1887	6	12	59
May, 1887	6	4	42				

OUR OCEAN LINERS.—The regular and fast steaming of the liners between Liverpool and America is well-known to all who take an interest in the mercantile pre-eminence of the port of Liverpool, but it is, we think, very rare to find a steamer which has been constantly engaged in the trade for a period of fourteen years completing her 132nd round voyage, or 264th passage, in that period, and at the same time maintaining her original speed and regularity. Such a record, however, belongs to the royal

mail steamer *Britannic*, of the White Star Line, which has completed her last four passages from New York to Queenstown in an average time of 7 days 14 hours 48 minutes, and on her last passage she ran a distance of 2,900 miles, between Sandy Hook (New York) and Roche's Point (Queenstown), in 7 days 18 hours 3 minutes mean time. The following is a copy of her log:—June 6th, left Sandy Hook at 5·15 p.m.; 7th, distance run, 290 knots; 8th, 368 knots; 9th, 364 knots; 10th, 362 knots; 11th, 362 knots; 12th, 369 knots; 13th, 369 knots; 14th, 416 knots; arrived at Queenstown at 3·40 p.m. It will be noticed that there is a difference of only seven miles between her longest and shortest day's run.

Accident on Her Majesty's Ship Dreadnought.—A Malta correspondent writes, under date June 11:—"A serious accident recently occurred on board Her Majesty's ship *Dreadnought* in Suda Bay. The steam picket boat, which, with coal, water, and engines, weighs about ten tons, was being hoisted in by the steam derrick, when a bolt gave way and the boat crashed down some 20 ft. on to her steel crutches. The steamboat hoist was smashed and the iron stanchions were broken up. The crutches pierced the picket boat right through, pinning it to the deck so firmly that it was found impossible to remove it with the appliances on board. Commander Prince Louis of Battenberg was standing on deck immediately underneath the picket boat when it fell, and he had a very narrow escape from being crushed to death or severely injured. The chief leading stoker, who was standing near Prince Louis, had an arm fractured and his head severely cut, and several men near him were rather badly hurt. Two men who were in the picket boat escaped with flesh wounds."

Reviews.

Asbestos; its Production and Use, with some account of the Asbestos Mines of Canada. By Robert H. Jones. London: Crosby Lockwood & Son.

Now that the use of asbestos in the arts and manufactures is becoming so general as to lead the author of this treatise to opine "that it will presently be found more difficult to say to what purposes it cannot be applied than to what it can and is," we heartily commend this little book to those of our readers who are desirous of obtaining all the most recent and most authentic information possible on a subject on which at present so little appears to be generally known.

The author appears not only to have gone thoroughly into the whole of the subject, as suggested by the title, but also to have taken great pains to place before his readers all the recent applications to which this valuable product has been put, and in every case he has been careful to see that before making any statement it was capable of ample verification.

Perhaps one of the most strange uses to which asbestos is put occurs in China, where, on the authority of one of their medical books, the author finds that it is used as a *tonic*.

The book is brought down to the most recent date (viz., April, 1888) and is written in a clear and withal entertaining manner that is, as a rule, not found in books of the kind.

The Pump Catechism: a Practical Help to Runners, Owners, and Makers of Pumps of any kind. By Robert Grimshaw. New York: Practical Publishing Co.

This handy little volume contains the fullest information on nearly every known type of American pump, many of which, by the way, judging from the number of their working parts and their general complexity, would seem to require a volume to themselves.

As the title implies, the information is given in the form of question and answer, and Mr. Grimshaw has certainly succeeded in producing a book which all pump users would profit by reading, for the author has not confined himself to the dry matter-of-fact description of pumps and their working parts, but has also placed before his readers a fund of, if we may use the term, "outside" information which cannot but prove useful to them.

The book is written in a thoroughly practical manner, is well illustrated and indexed and is pithily dedicated "To every one who wishes to know more to-morrow than he did yesterday," and to such we commend it.

The Naval Annual. 1887. By Lord Brassey. Portsmouth: Griffin & Co.

The second volume of Lord Brassey's "Naval Annual" places before the naval reader one of the most complete reference books on the subject of naval construction and armaments that has yet appeared. Though the book, as a whole, is, we believe, entirely owing to the enterprise and patriotism of Lord Brassey, it is but due to say that the second, third, and fourth sections of the work have been contributed respectively by F. K. Barnes, Esq., Capt. Orde Browne, and Lieut. Speerman, while Sir Nathaniel Barnaby and Mr. Barnes have contributed the chapters on the Progress of Steam Navigation, the Mercantile Marine, and the Mosquito Fleet; and that, read from cover to cover, it shows not the slightest political bias or tendency.

The book is divided into four sections: the first, of fifteen chapters, dealing with Recent Naval Administration; the second dealing with British and Foreign Armoured and Unarmoured Ships; the third treating of Armour and Ordnance, while the fourth deals with Torpedoes. In addition to these four sections the work is supplemented by a most important appendix of 252 pages, which gives not only all the available information respecting our own navy and its control, construction, manning, &c., but also gives the chief points of interest in connection with the navies of all the leading foreign Powers.

Probably to the naval officer wishing to acquaint himself with the most recent phases of war-ship construction and performances the second section of the book will prove the most interesting, giving as it does all the leading dimensions, particulars of armour and armament, speed and turning capabilities, &c., of all known British and foreign war-ships. The value of this section is greatly enhanced by the addition of 147 plates, in which every important war-ship is illustrated, the armour being shown coloured. It may interest our readers to know that under the heading "Personnel of the Navy," and comparing the years '76 and '86, by far the largest increase of numbers has been in the engine-room staff, the numbers being respectively 4,279 and 6,983, or an increase of 2,704 in the ten years.

In the section dealing with armour and ordnance several of the latest forms of magazine rifle, and the new model of the Winchester repeating rifle, are fully described and illustrated, as is also the new rapid firing 30-pounder gun. The new monsters, of 111 tons each, for the *Victoria*, *Sans Pareil*, *Benbow*, &c., together with the ammunition and fuzes to be used in connection with this latest production of the gun makers, also come in for description and illustration in this very interesting section of the book, which further shows the performances, in the way of perforation of plates, of the leading English, French, and German guns. The pressure and velocity curves of the old and new type of 25-ton gun, given in this section, are very interesting as showing the vast increase of efficiency attained from the same weight of gun.

Lord Brassey's account, in section 1, of the French naval operations shows to what terrible use the modern engines of warfare can be applied when directed by skilful hands, and in this connection it is satisfactory to know from the figures given in this and other sections of the book that we are not behind our neighbours in numbers, or quality, of these dread instruments. As showing the cost of modern improvements on board ships of war we may mention that in the German naval estimates the sum of £3,000 is put down, per ship, for electric lighting plant alone.

We should not, bearing in mind the present excitement anent our so-called naval inefficiency, do well if we closed our notice of this most interesting book without quoting from its pages a short abstract from a speech therein given. The speaker, Monsieur Menard Dorian, in the discussion on the French navy estimates, said, "Picture to yourselves the results of the first encounter between hostile fleets! Most terrible assuredly they must be, with the means of destruction which science has placed at the command of the Navy. It is probable that both sides will be but ill-prepared to renew the engagement. The survivors from the first struggle will be too few to resume the combat. With whom, then, will the supremacy over the seas remain? With the nation possessing the largest industrial resources; with that Power which shall be the first to replace the fleet destroyed by the rapid construction of a new fleet. Therefore it is that the real strength of England lies, not in her dockyards, not in her public establishments, but in the combined creative resources of her private shipbuilding yards. Those yards occupy a position more secure from attack than ours. But we cannot trace anew the coasts of France. It is not in our power to create seaports, like those of England, far up navigable rivers, combining facility of access from the sea,

with the advantages for the purpose of defence of an inland position."

If comment on this were needed Lord Brassey furnishes it when he says, speaking of ships built by contract, "An ironclad of the largest class will be completed in less than four years by a firm never before engaged upon a similar construction. Our noble fleet of belted cruisers will have been completed in little more than two years from the day when the orders were given. From a single yard, not possessed of at all exceptional resources, six vessels of the *Archer* class, 1,630 tons, 3,500 horse-power, have been turned out in eighteen months. Fifty torpedo boats were built by two firms in six months."

From this it may be inferred that, given the Government saw the necessity for more ships and ordered them, they would soon be forthcoming.

A word of praise is due to Mr. W. F. Mitchell, the marine artist of Ryde, for the very excellent drawings furnished by him for the eight full-page (tinted) plates with which the volume is embellished, and indeed, authors, publishers, and printers appear to have done their utmost to produce a book of the highest excellence in every respect.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from May 18th to June 14th, 1888.

5407A J. Tarrillion. Boats.
7367 J. Price. Life belts or buoys.
7370 A. Oldham. Metallic piston packing.
7384 E. Lawson, E. W. de Rusett, & H. Lea. Ships' berths.
7467 A. F. Yarrow. Vapour engines.
7477 N. Blezard. Causing vessels to travel along canals, &c.
7495 T. Gallon & J. Chapman. Hydraulic engines for driving capstans, &c.
7526 H. C. Payne & A. W. Burstow. Screw propeller.
7548 U. Dieuleveult. Floating telegraphic station.
7614 C. Krause & R. Collin. Water motors.
7627 T. S. McInnes. Engine indicators.
7631 F. A. L. de Gruyter. Raising and lowering ships' boats.
7709 Thompson (J. P. Serve). Ribbed tubes for boilers.
7711 A. H. Stott. Mechanical stokers for marine boilers.
7724 G. Chapman. Propelling vessels.
7755 R. W. Kinipple. Closing or bridging across deck entrances or harbours.
7759 Sir N. Barnaby. Battle-ships.
7770 E. J. Bean. Ships' steering gear.
7786 R. Werner. Propulsion of boats.
7790 G. Tate. Propulsion of ships' and other boats.
7837 R. J. Rae. Ships' windlasses and capstans.
7875 D. Jay. Mounted guns or ordnance.
7879 R. Whitehead. Launching torpedoes.
7887 J. Grisenthwaite. Swivel rowlock.
7890 W. Scotson & J. Willis. Anti-corrosive enamel for propeller blades, ships' plates, &c.
7935 E. H. Tyler. Submarine vessels.
7943 A. T. Miller. Ships' yards, masts, &c.
7980 G. Undén. Canoes, &c.
8002 Groth (J. F. Monnot). Ships.
8010 E. C. Mills. Speed recorders for engines.
8022 D. McI. Reid. Boats or vessels.
8107 J. H. Scott. Feed water heaters for marine boilers.
8119 C. L. Hett. Centrifugal pumps.
8863 A. H. Carpenter. Blades of paddle wheels.
8167 J. Standfield. Canal, bridge, and other lifts.
8236 T. Nordenfeldt. Range finders.
8293 Haddon (W. Hoffmann). Propellers and rudders.
8302 W. T. W. Thackeray & I. Hurn. Indicating whether orders on board ship are carried out.
8305 R. Baron de Mauni. Propelling spring oar or rowlock.
8310 P. Roberts. Boiler smoke consuming.
8321 R. C. Rapier. Cable chains.
8326 T. Henderson. Slide valve.
8330 J. S. Taylor & G. Steed. Signalling at sea, &c.
8349 J. C. R. Okes. Duplex pumping engines and motors.
8353 T. B. Heathorn. Steering, propelling, &c., boats.
8378 H. Hutchinson. Stockless anchors.
8381 P. J. Lynam. Range finders.
8455 W. Hargreaves & W. Inglis. Corrugated shells for boiler furnaces.
8501 W. Keen & R. H. N. Alleyne. Caulking seams of steam boilers.
8520 F. Hunt & C. Crockford. Marine governor.
8550 E. Leckner. Purifying boiler feed water.
8572 W. R. Hayes. Ventilation of ships.
8593 W. J. Bosley & W. W. Dickson. Steam boiler safety valve.
8629 J. E. T. Bartlett. Propeller wheels.
8660 P. J. Lynam. Range finders.
8697 J. Sandeman. Mariners' compasses.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1 C, denotes First Class; 2 C, Second Class.

May 26th, 1888.

Anderson, Wm.	2C	N. Shields
Bone, Robert, ..	2C	,,
Bridie, R. H. ..	2C	Glasgow
Burleigh, Jas. ..	1C	N. Shields
Caig, Wm. R. ..	1C	Sunderl'd
Cannon, Thos. ..	2C	Liverpool
Crinall, Robt. A.	2C	Sunderl'd
Coegan, Wm. ..	2C	Hull
Davison, W. M.	2C	N. Shields
Dial, Richard ..	1C	Sunderl'd
Dobbs, W. James	2C	London
Frazer, Edwin H	2C	Sunderl'd
Hall, Henry E.	1C	Sunderl'd
Horncastle, W.E.	1C	,,
Jameson, E. H.	1C	N. Shields
Kennedy, Arch.	1C	,,
Logan, James ...	2C	,,
MacIver, Geo. G.	1C	Glasgow
Martin, E. E. ..	2C	Hull
McKay, Geo. R.	2C	Aberdeen
McLachan, F. G.	2C	Hull
Mitchell, Alex...	1C	Aberdeen
Murray, Thos...	2C	Glasgow
O'Hagan, Felix	1C	London
O'Sullivan, Tim.	1C	Glasgow
Page, Thos. H.	1C	London
Pocklington, A.	2C	Hull
Ramshaw, Jas. J	2C	Sunderl'd
Rispenhausen, W	1C	London
Ritchie, James	1C	Glasgow
Robertson, Hen.	1C	,,
Russell, John ..	2C	Aberdeen
Simpson, Jos. E.	1C	Sunderl'd
Smith, John W.	1C	London
Taylor, Alfred ..	1C	Sunderl'd
Thomson, Wm.	2C	,,
Turner, Edw. ..	2C	Liverpool
Voyce, Wm. H.	2C	N. Shields
Wilson, Arthur	2C	London

June 2nd, 1888.

Boyd, Wm. M.	2C	Liverpool
Davey, W. Mart.	1C	London
Garmey, Henry	1C	N. Shields
Haddow, Andw.	1C	Liverpool
Mayo, Wm.	2C	Cardiff
Morris, David ..	2C	,,
Thomas, W. L.	2C	,,
Tully, Andrew	2C	Sund'land

June 9th, 1888.

Blair, Wm.	1C	N. Shields
Burn, T.	2C	Dublin
Brown, A.	1C	Leith
Brown, W.	2C	,,
Dotchin, John A.	2C	N. Shields
Ferguson, James	2C	London
Forsyth, J.	1C	Greenock
Foster, Edward	2C	London
Gilmore, J. B...	2C	Greenock
Grey, George ..	1C	London
Hardman, Edm.	2C	Liverpool
Hardy, W. W.	1C	N. Shields
Horne, A.....	1C	Leith
Jordon, C.	2C	,,
McArthur, F. ..	2C	,,
McCulloch, A. ..	1C	Greenock
Purnell, Chas. A.	1C	London
Rippingille, H.T.	2C	,,
Robertson, A. S.	1C	Greenock
Roper, Robt. ..	2C	N. Shields
Scott, A.	1C	Leith
Sunney, B.	1C	,,
Swinston, Richd.	1C	N. Shields
Symington, G...	2C	Leith
Wilson, B. C. ..	1C	Greenock

June 16th, 1888.

Bradley, Wm. ..	2C	Dublin
Cass, Geo. W. ..	2C	W. H'pool
Fletcher, Isaac..	1C	Liverpool
Gibbons, W. G.	1C	Hull
Glen, J. M.	2C	Dundee
Hanxby, Thos.	2C	W. H'pool
Heseltine, C. R.	2C	,,
Hogg, R. B. ..	1C	N. Shields
Hutchison, H. C.	1C	London
Jeffrey, R. A. ..	1C	N. Shields
McAdam, Thos.	1C	Liverpool
McKendrick, R.	1C	London
McMahon, Peter.	2C	W. H'pool
Pearson, Walter.	1C	Liverpool
Prudham, Henry.	1C	W. H'pool
Richardson, Geo.	1C	Dundee
Rose, C. E. S. ..	1C	Liverpool
Stony, Walter...	2C	Hull
Trimble, Robt...	2C	N. Shields
Watson, John...	2C	,,
Wheelwright, J.	1C	W. H'pool
Wilson, A. J. ..	2C	Hull

JUNIOR ENGINEERING SOCIETY.—The adjudication of the prize offered for the best paper read by the members of this Society during the seventh session has resulted in its being awarded to Mr. Francis R. Taylor for his paper on "The Illumination of Lighthouses." The prize will be presented by Professor W. Cawthorne Unwin, M. Inst. C.E., president elect, at the inaugural meeting of the eighth session in October next, at which the presidential address will be delivered.

The Marine Engineer.

LONDON, AUGUST 1, 1888.

EDITORIAL NOTES.

SHOULD coal become dearer—and there are many indications at present that the era of cheap coal is about to pass away—an exceptional amount of interest will be attracted to the burning of liquid fuel. As regards the tendency to dearer coal, we seemed to have reached the maximum production in 1883, the output for the year being 163,737,000 tons for the United Kingdom. Since that year to the present the output seems to have steadily dropped; but in the past year, despite the long strike in Northumberland, it shot up to 162,119,000 tons, and the output is still being enlarged. Nearly all classes of demands seem to be on the increase, including exports and house consumption (which no doubt may be put to the bad weather), and the manufacturing demand is considerably greater. This promises well for the steady and general augmentation of business in the United Kingdom; but the rise of price in fuel will certainly lead its users to look round for such methods or improvements as may tend to lessen the waste of coal in consumption, to increase the utilization of power from that fuel, or to substitute a cheaper fuel, such as petroleum, in place of the more expensive coal. There is still much to be learnt with regard to the best methods of employment of liquid fuel in boiler furnaces. Should the late experiments of utilizing the evaporated gas of the oil itself as motive power, as lately put into operation by Messrs. Yarrow and Co., succeed, then the question of burning the liquid fuel to the best advantage in the furnace of a steam boiler will be obsolete. There is, however, quite a distinct method for the utilizing of liquid fuel in the ordinary furnaces of a boiler which has already been largely put into practice on the Caspian Sea and Russian rivers. The essence of this process is that the oil stream is injected through a nozzle or nozzles and sprinkler by compressed air or steam, and there are many details that have to be studied in this method of oil burning to carry out the same successfully. Where an auxiliary boiler or air chamber is applied the burning jet of oil can be set going very rapidly within a period of three-quarters of an hour. Where no auxiliary air chamber or boiler can be applied, the steam or air pipe is conducted along the floor of the furnace, which it covers in a sort of zigzag fashion, and runs from thence to the sprinkler. To set the sprinkler in action a small hand pump, with a carefully closed chamber, is fitted up to communicate with the zigzag pipe by means of a regulating valve. To light the fires a few handfuls of wood dipped in oil are placed on this pipe, and the chamber is filled with water. A little water is then admitted to the zigzag pipe which passes through the sprinkler under pressure. The oil can now be admitted to the sprinkler, and being evaporised by the steam, is ignited by the wood fire. The steam now generated in the pipe by the burning oil can be used for evaporisation until the steam in the boiler or the air pipe which is worked by it can be used. The apparatus then is in regular swing. Care has to be used in employing this apparatus, as the oil must be shut off first and then the steam jet. If this order be not rigidly observed explosions in the furnaces may easily occur, which, although they might not seriously injure the boiler, would still do considerable damage. It is also sometimes urged that the rapid consumption of fresh water from steam jets will necessitate consequent introduction of salt sea water into the boiler. It is found, however, by experiment that the entire steam consumption to work them is not more than three per cent., which if not carried as a reserve must be replaced by sea water. This small percentage is not likely to create much difficulty in the shape of deposit. Should, therefore, the price of the usual coal fuel rise much further, it is extremely probable that much attention will be directed to the best known methods of burning liquid fuel in the shape of oil.

THE historian Hemingway, referring to the picturesque and historical old city of Chester, pronounced the opinion, fifty years ago, that it was "a place by no means distinguished for speculative enterprise." Subsequent events have amply justified the not too flattering remark. A casual visitor to the Dee to-day could scarcely imagine, much less describe, that the river, now rapidly silting up, was once thronged with shipping, while upon its banks flourished the enterprising shipbuilder. It is extremely doubtful, however, if the historian ever conceived the possibility that Liverpool, which was once subordinate to the Comptroller of the now sleepy old town, and in the patent styled "a creek of the port of Chester," would ever lay claim to be considered the first seaport of the world, while its once prosperous parent would sink into oblivion. Although the Manchester Ship Canal and Ribble schemes are looming in the distance, and croakers are asserting that with these rivals in the field we shall witness a luxuriant crop of grass growing on the quays of the magnificent line of docks at Liverpool, it would

appear that the Mersey Docks and Harbour Board do not anticipate any such catastrophe, nor yet the London and North Western Railway Company, whose docks are situated on the Mersey at Garston. Since our last issue much has happened to silence the croakers who tell us Liverpool has passed its zenith. The Railway Company having piloted their Bill, to construct additional docks at Garston, safely through the shoals and quicksands of a Parliamentary Committee, will shortly proceed to spend half a million of money upon the undertaking. The total traffic at these docks is about 2,000,000 tons annually, consisting principally of iron and copper ore, cotton and coal cargoes. Vessels entering Garston docks not only escape payment of sundry heavy dues levied by the Dock Board at Liverpool, but gain certain concessions from the Railway Company. The Mersey Docks and Harbour Board are, therefore, likely to continue to suffer from a thorn in its side.

But in spite of this healthy competition, the great port of the north can point with pride and satisfaction to the statistical returns furnished annually on the 1st of July by the accountant to the Dock Board. The total tonnage entering and leaving the port of Liverpool—and this does not include Garston—for the years ending July 1st was as follows :—

1887 tonnage	... ...	8,797,783 tons
1888 ,,	... ...	9,017,935 ,,
Increase this year	... ...	220,152 ,,

Steam is slowly but surely taking the wind out of the sails—if that is not Hibernian phraseology—if we may cite the tonnage of steam and sailing ships paying dock dues at this port as any general criterion. We give the returns for steam and sail in their respective order :—

Steam.	1887.	1888.	Increase.
Foreign	4,361,960	4,409,222	47,262
Coastwise	1,919,133	2,194,468	275,335
Sail.	**1887.**	**1888.**	**Decrease.**
Foreign	1,065,371	963,548	101,823
Coastwise	259,571	232,860	26,711

Similar results are obtained with reference to vessels paying harbour dues only, sailing ships decreasing and steamers increasing, but it is not necessary to quote them. This is cheering news for readers of this journal. Another interesting feature to be found in these statistical returns is the fact that there is a decided tendency on the part of shipowners to build a larger class of vessel. While the aggregate of the year's tonnage has increased by nearly a quarter of a million tons, the number of ships using Liverpool has only increased to the extent of 357. It would almost appear that the Mersey Docks and Harbour Board had years ago contemplated the rapidly increasing trade now so fully developed, for in 1873 they obtained the sanction of Parliament to further increase their gigantic dock accommodation. May last saw the Toxteth dock opened, and this concluded the extension project, in so far as docks to the southward of the river are concerned. Mr. G. F. Lyster, the eminent engineer to the Board, however, has evidently been studying how to improve the ancient docks, which are fast becoming obsolete, owing to an insufficiency of depth of water to float the larger class of ships which desire to enter these enclosures, for we hear that he has arrived at, after a series of successful experiments, a thoroughly satisfactory, practical, and economical solution of the problem. Immediately to the southward of the landing stage extends the obnoxious Pluckington Bank. Along the edge of this are three river entrances to the Wapping, King's, Queen's, Coburg, and Brunswick docks. These are shallow, or half-tide docks, and are only available for large vessels during spring-tides. The engineer intends, by an elaborate plan of pumping, to obviate this, and render them serviceable during the whole of the year for vessels of deep draught and considerable tonnage. There are now being erected on the pierhead of the Coburg dock three large centrifugal pumps, with compound-condensing engines, each pump having a suction 54 in. in diameter, and capable of delivering 57,000 gallons of water per minute. Together the three will pump 15¼ million gallons through an average lift of 43 in. in 90 minutes. The Herculaneum dock—one of the modern class—has a deep-water entrance, with two sets of gates, and between this and the old docks before mentioned there is being constructed a connecting dock or lock 500 ft. in length and 120 ft. in width. Shortly before high water vessels will congregate at this lock, as the only entrance to and exit from these docks for large vessels will, when the arrangements are completed, be through the deep-water approaches of the Herculaneum. Vessels not requiring to take advantage of the extra depth will still use the half-tide entrances previously alluded to. Special arrangements will be made to suit the traffic in the Coburg. An hour-and-a-half before high water it will be allowed to run down, and at high water mark the gates will be closed for pumping. Without taking into consideration the loss of water arising from lockage, leakage, and the use of the half-tide entrances by smaller craft, it is anticipated there will be retained a minimum depth of 22 ft. of water. This ingenious plan will not only obviate an

enormous expenditure on reconstruction, but prevent the loss of revenue which the closing of several docks for a considerable period would involve. If the Mersey Docks and Harbour Board continue to manifest this unceasing watchfulness and enterprise, Liverpool may still be able, to adopt the phraseology of the sporting fraternity, to "defy all comers," and maintain that proud position which she now holds in the mercantile and commercial world.

As we have taken a very considerable interest in the rise and progress of Cardiff as a port, it may be excused if we point out that it may be well for that interesting town to note that the Barry Dock will in a few months be open and that those interested in the rival port can probably influence the shipping of at least three million tons of coal per annum. As this is the staple export of Cardiff, it will make a considerable difference in the total trade passing through that port, and it behoves them to be up and doing in the face of such a serious possible check. As the facilities for loading and unloading direct from and to the main lines of railway are so splendid at Cardiff, and their communication is direct with most of the main lines of railway to London, the Midlands, and the North, it would appear that Cardiff has every facility for still holding its own. It is a curious fact that the value of the exports at Cardiff are so greatly in excess of its imports; and yet it is difficult to see why so much shipping should thus return in ballast where there are such good freights for them outward. In other ports, some not very far from Cardiff, and others such as the Tyne ports, the imports are even very largely in excess of the exports. Why this difference should exist is probably because the Cardiff shipowners have not paid sufficient attention to the question of imports, the exports being their chief business. As the distributing centre to a large portion of England, Cardiff is very well situated; the quickness of delivery from the west should be greater than any other port farther east, and there are very few other ports that have equal facilities for direct loading into the main lines of railway. Possibly the dock authorities may not have paid sufficient attention to this point, and do not offer the required facilities for a distributing port. Were they to enter into sufficiently supported negotiations with the main lines of railways in direct communication with their docks, special carrying rates for distribution might be arranged. Possibly the goods hitherto shipped from Cardiff have not suited return markets, being too closely limited to coal and iron, and the limitation may have been caused simply by the dock authority not paying sufficient attention to any other line of business than their own specialties. We trust the management of the Bute Docks is paying sufficient attention to this point, or that were the Barry Dock to secure a considerable slice of Cardiff export coal trade, the latter might still use such a determent to a useful purpose by opening up a more general trade, which in such cases could be probably made to pay at a double rate, by reason of its bringing a corresponding amount of return imports.

Water carriage has so rapidly of late years come to the front for the moving of heavy goods that the result has been the development of a series of inland canals to control or avoid the monopoly of railways. Sheffield and South Yorkshire have for many years been face to face with such heavy transit rates as to disastrously affect the heavy industries in many markets, they are now in consequence discussing in an earnest manner an important question of constructing a waterway from Sheffield to the Humber. The canal would terminate at Goole, which is a rising port on that river. It is, then, now only a question of the cost of the work and the economy resulting from the improved cheaper mode of transit. As this question is of vital importance to many of the Sheffield manufacturers, the scheme is likely to be well supported, and as a rage has lately seemed to exist for this kind of commercial enterprise the work would probably be energetically carried out, unless the railways were to meet the exigences of the situation. As the difference of rates charged for land transit often means in the present state of trade a profit or none in foreign markets, where there is direct competition with other manufacturers, some such arrangement must necessarily be made, as it is a well-known fact that of the transit of goods from any inland town in England to foreign parts the railway transit generally forms the larger proportion of the whole rates charged. This process may be very unpleasant to railways who have hitherto held practically a monopoly of the carrying trade, but when it begins to affect the possibility of reaching foreign markets at a selling price, or in not reaching those markets at all, the railways, if they were wise, had better take lower rates than none at all, as the closing of a market is certain to reduce the amount of goods carried.

It is very difficult for an outsider to make head or tail of the conflicting statements that are constantly being made in Parliament as to the really efficient or inefficient condition of the Navy at the present time as the

protection to our enormous floating commerce. The question as to the most suitable designs for ironclads we think we may consider to be a question which is not likely ever to be definitely closed, until at any rate a great naval war has decided practically many of the conflicting therories of the different designs. With this point as a nation it would appear best not to disturb our minds, but let the progress of events bring practical experience to all, so long as we are not more likely to suffer by that experience than other nations; but what is much more agitating to the national mind at large is, that whilst conflicting designs of both ships and ordnance seem to be interminably discussed, nothing seems to be got on with, and that which is being done is so badly organised that a large portion of even our nominally completed navy is practically useless against any sudden emergency. Most of our private firms, who seem really to be doing the most efficient work, judging by results, in best designs, owe most of their practice and experience to the orders of foreign countries, whilst our ministerial departments are wrangling among themselves as to what may be right or what wrong in details. There is no other nation that has our facilities with the producing powers of our national dockyards and arsenals, together with our private firms who have been forced into the market by outside orders, and yet so little is the enterprise and efficiency of private firms recognised by the Government, and when such enterprise is actually made use of it is so hampered by the vacillation of the Government designers, that no efficient and completed work is produced to anything like time. It would surely be best for the Admiralty authorities when they don't know their own minds to give private manufacturers freer hands, as they invariably have when building for foreign Governments, and thus benefit by the suggestions and designs of such firms, which are certainly not likely to be inferior to their own, if we may judge by the accounts of the splendid ironclads, both as regards strength, speed, and armament that they are constantly producing for foreign Governments. If it is professional pride on the part of the Admiralty that prevents them receiving suggestions and assistance from the best and highest paid skill obtainable in the country, employed by the best private firms, the sooner the nation at large puts its foot down and stops all such nonsense the better. The latest statements that have been made with regard to the lamentable want of guns to arm ironclads ready for commission, and no reserve of such ordnance to replace guns now considered almost obsolete, or to supply all damage and loss to be sustained in any naval warfare we might have to engage in, is regrettable in the extreme. Much reliance is at present placed upon the fact that we have a reserve of many of the Atlantic liners, and to a certain extent these may be valuable as swift vedettes constantly traversing the seas, but we know too much of the frailty of such vessels in collision to believe they are likely to stand for any length of time in a rough and tumble naval fight with a much smaller cruiser or ironclad specially built for ramming or resisting shot and shell. Their speed may be all very well, but they would be of little use as protectors of our commerce if their only alternative were to run away whenever they saw an enemy.

SLIDE VALVE GEARS.*

By Mr. J. T. MILTON, M.I.N.A.

(*Continued from page* 124.)

NEXT consider two forms of valve motion originally introduced by Hackworth, and the modifications of these forms known as Marshall's system.

In each of the two styles of Hackworth's gear the motion is obtained from one eccentric, working in an eccentric strap or lever, the general direction of which is at right angles to that of the slide rod. One point (or fulcrum) of this lever is constrained to move in a straight line, the inclination of which may be varied, and the motion of the valve is taken from another point of the lever. In one form of gear the eccentric is placed opposite to the crank, and the motion is taken from a point between it and the fulcrum, while in the other type the eccentric is placed in the same radial direction as the crank, and the motion of the valve is taken from a point in the lever on the side of the fulcrum remote from it.

The principle of these motions is shown in Fig. 9. Here C is the centre of the shaft, A the centre of the eccentric, A B the centre line of the eccentric lever, a point B in which is constrained to move in a straight line which always passes through O, but the direction of which may be varied between the limits K O L and G O H; E O F, the mean position of this line, if produced, passing through C. The position of B in the lever is such that when A is on the top or bottom centre, B will fall at O. It follows, therefore, that at whatever inclination K O L may be set, the position of the lever is always the same, and therefore also the position of the valve is the same, when the eccentric (or crank) is on either centre. In other words, with this kind of gear the lead is constant for all degrees of "linking up." The slide rod obtains its motion from the point D or D′ in the lever, which point will move in a curved path. The vertical component only of the motion of D will be transmitted to the slide, and this vertical motion is obtained partly from the vertical motion imparted to the end A of the lever by the eccentric, and partly from the vertical motion of the end B. The motion imparted to it by A is $\frac{D\,B}{A\,B}$ times the vertical motion of A, and that by B is $\frac{A\,D}{A\,B}$ times the vertical motion of B.

The vertical motion of B is always equal to its horizontal motion, multiplied by the tangent of the inclination of the guiding line to its mean position; and since the horizontal motion of B is that produced by the eccentric A, the vertical motion of B must also be proportional to the horizontal motion of the eccentric A. The two points A and B of the lever A B will therefore have their vertical motions such as would be produced by eccentrics at right angles to each other, the motion imparted to the slide rod by A being that due to an eccentric radially in the same direction as the actual eccentric, but with an eccentricity equal to $\frac{D\,B}{A\,B}$ times that

* *Read at the North East Coast Institution of Engineers and Shipbuilders. Theodore Doxford, Esq., President, in the Chair.*

FIG. 12.

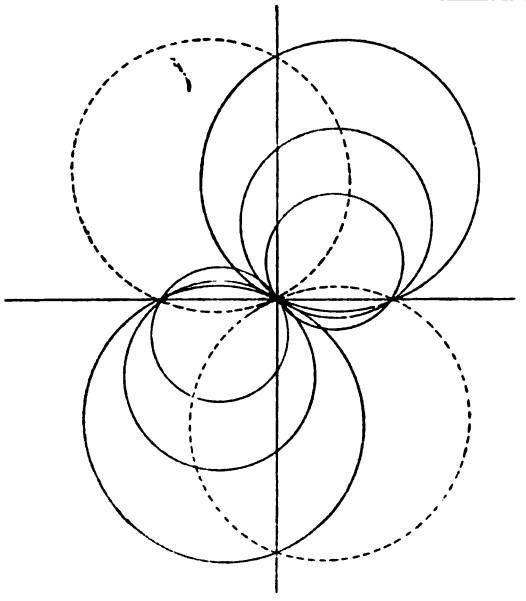


FIG. 15.

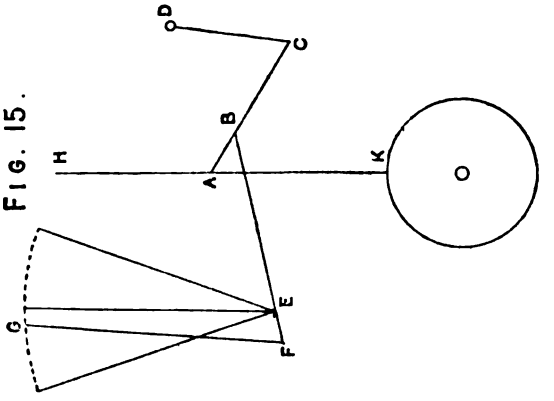


FIG. 11.

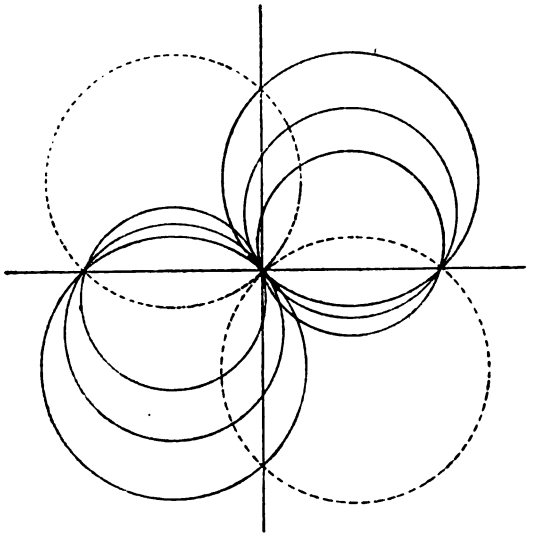


FIG. 14.

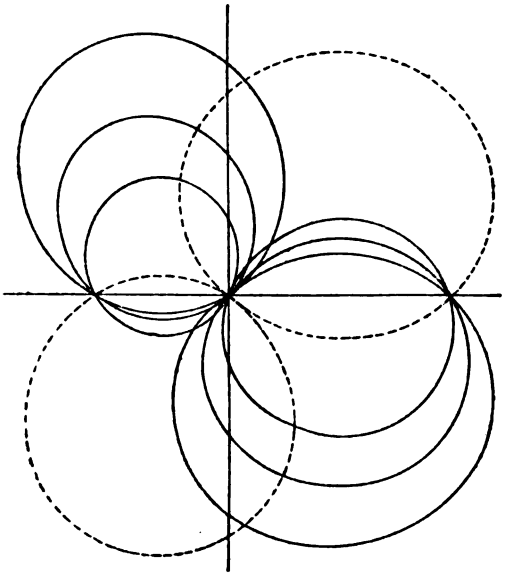


FIG. 9.

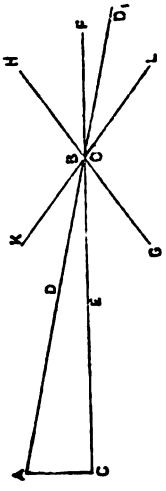


FIG. 10.

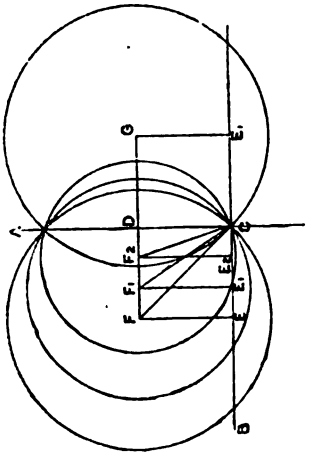


FIG. 13.

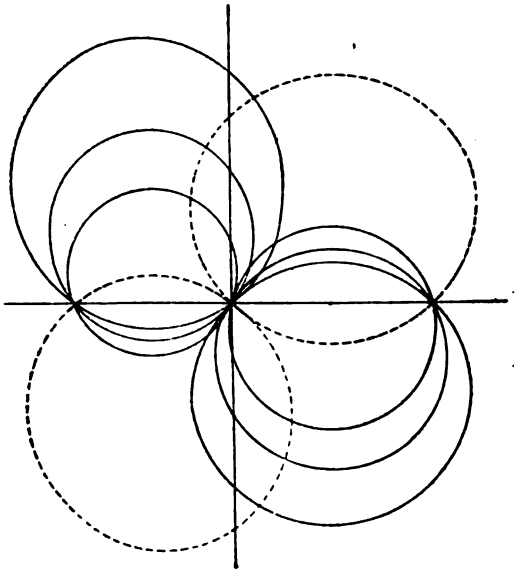


FIG. 18.

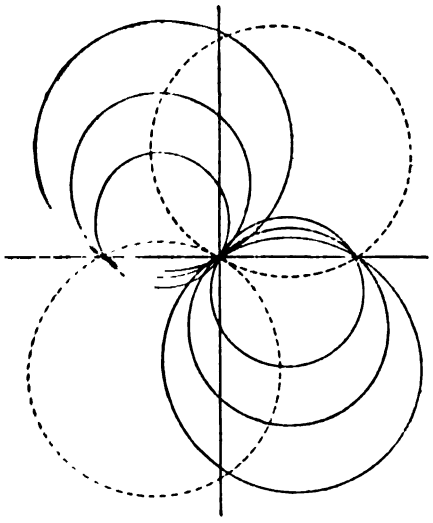


FIG. 26.

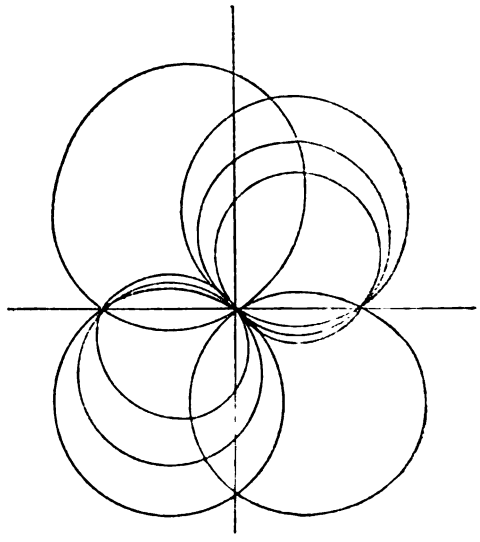


FIG. 17.

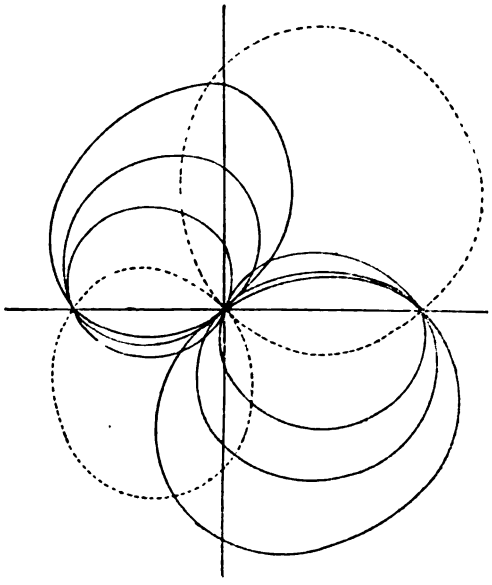


FIG. 25.

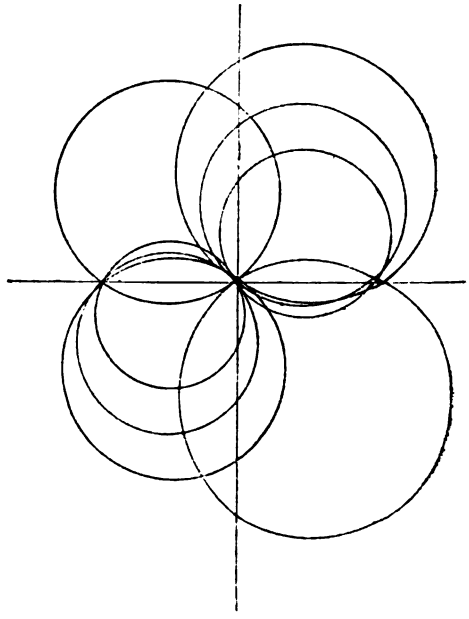


FIG. 16.

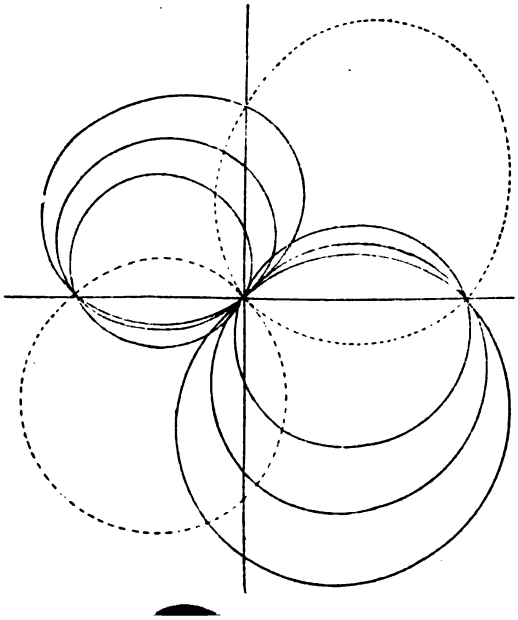


FIG. 19.

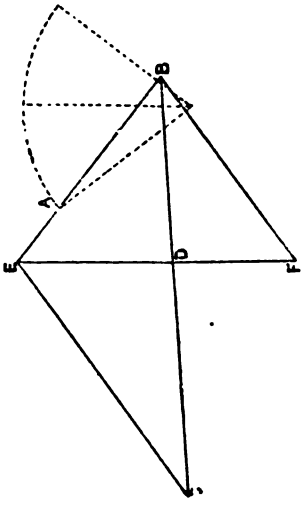
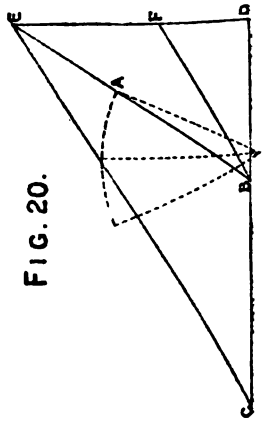


FIG. 20.



SWINGING LINK GEAR.

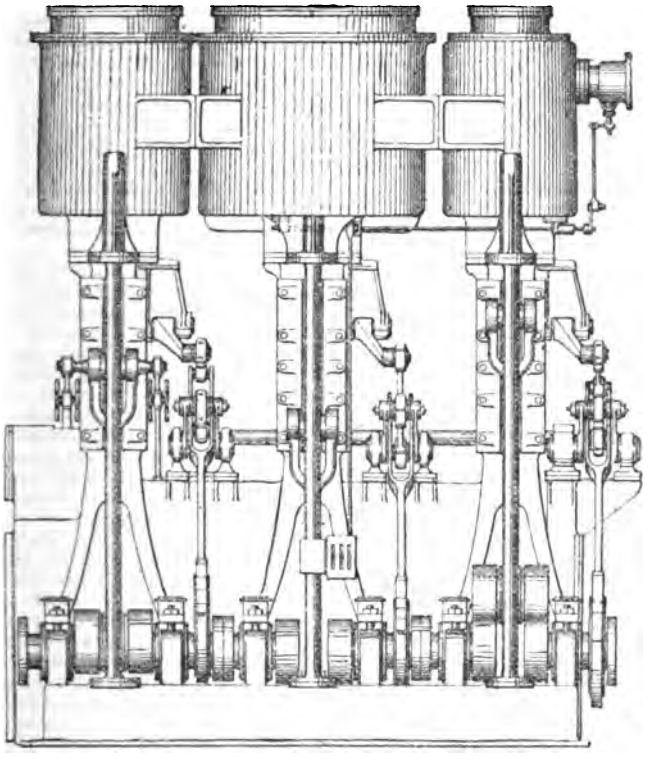


FIG 29

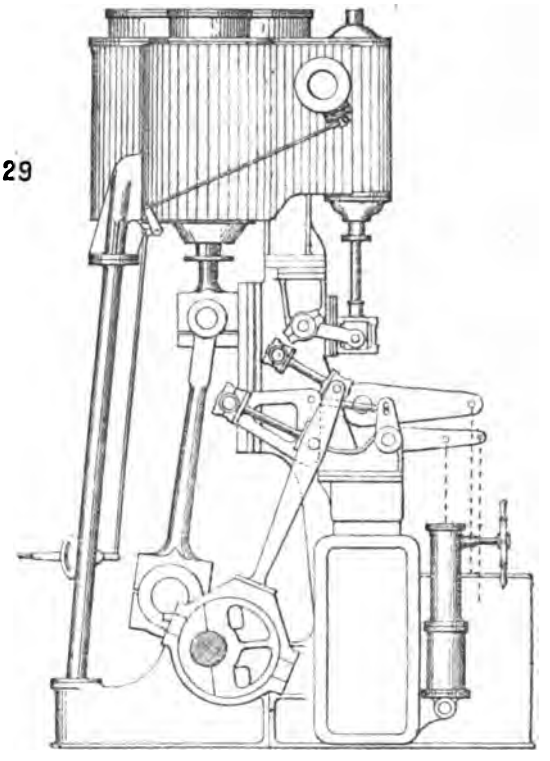
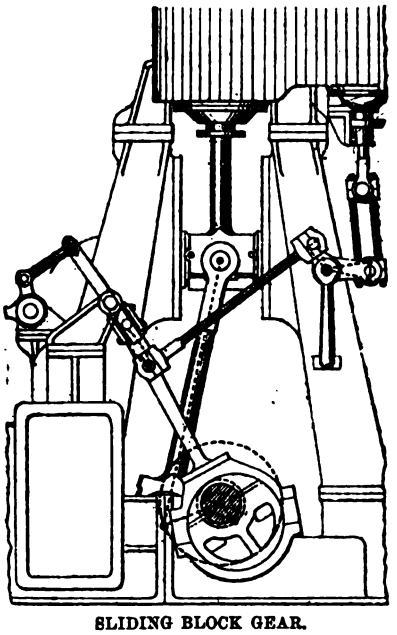


FIG. 30



SLIDING BLOCK GEAR.

of the eccentric, while that imparted by B is due to an eccentric at right angles to the other, with a throw equal to $\frac{A\,D}{A\,B}$ × tan inclination times that of the actual eccentric.

The latter of these is the only part which admits of variation. When the inclination of the guiding line is zero, the vertical motion of B becomes zero also; and when the inclination becomes reversed, what was an upward motion becomes a downward one, and *vice versâ*.

In the form of gear in which the motion is taken from the extreme end of the lever, the eccentric is placed in radial line with the crank, and so the motion as affected by A, being reversed by the fulcrum being towards the centre of the lever, is in the same direction as in the other gear in which the eccentric is placed diametrically opposite to the crank.

Fig. 10 illustrates the motion produced by both gears (still neglecting the effect of the angular motion of the lever). Here

$$C\,A = \text{throw of eccentric, and}$$
$$C\,D = \frac{D\,B}{A\,B} \times C\,A\text{; also if}$$
$$C\,B = \tan \alpha \times C\,A,$$

α being the maximum angle of inclination of the guiding line, make

$$C\,E = \frac{A\,D}{A\,B} \times CB,$$

then the motion of the valve will be that due to the combination of the motion of eccentrics having centres situated at E and D respectively. Hence, by drawing E F and D F parallel to C D and C E, it is seen that the motion is such as might be produced by a single eccentric with its centre at F.

For "linked up" positions, since it is only the effect of B which is variable, the motion will be such as would be produced by eccentrics with centres situated at F_1 F_2, etc., along the line F D, where F_1 D bears the same proportion to F D as the tangent of the inclination of the guiding line in its "linked up" position does to the tangent of its maximum angle of inclination. Similarly, for the astern gear, we see that if D G = D F, the astern motion is such as would be produced by an eccentric having its centre at G.

If account be taken of the obliquity assumed by the lever in its various positions, Figs. 11 and 12 represent the actual motions produced. As may be seen, the curves representing these motions differ very little from circles, and the gears still retain the property of giving a constant lead.

In Marshall's system the constrained point, instead of moving in a straight line, which involves making it move in guiding grooves or the use of a parallel motion, moves in the arc of a circle. This is effected as shown in Figs. 27 and 28, page 122. In these systems there is a difference in the amount of the motions of the top and bottom portions of the travel of the valve, owing to the difference in the mean inclination of the arcs described by the end of the pendulum link, but this difference becomes less as the proportion between the length of the pendulum link and the throw of the eccentric becomes greater.

Figs. 13 and 14 show the actual motion obtained by these forms of valve gearing, both when in full-ahead and full-astern gear, and they also show the motion in intermediate or "linked up" positions of ahead gear.

It is only necessary to draw attention to the valve gears, described by the late Mr. Wyllie in his Paper read before the Institution of Mechanical Engineers, Figs. 29 and 30, to see that they are essentially the same as those here described, the *swinging link* gear being identical with one form of Marshall's system, with the direction of motion changed by the introduction of a bell-crank lever, while the *sliding block* gear, Fig. 30, is a form of Hackworth's motion, with the direction similarly changed. The motion described by Mr. Mudd during the discussion on the Paper is also an application of one of the forms of Hackworth's gear.

In Joy's valve gear eccentrics are entirely dispensed with, the whole of the motion being taken from the connecting rod. Fig. 15 shows an arrangement of this gear suitable for vertical engines (reproduced from the figure given by Mr. Joy in his Paper, read before the Institution of Naval Architects in 1885). H K represents the connecting rod, H being the centre of the piston rod crosshead, and K the centre of the crank. A rod, A B C, has one end jointed at A to a point A fixed in the connecting rod, and the other end C jointed to one end of a radius link D C, the upper end D of which is fixed. The end A therefore describes an oval figure during the revolution of the shaft, the vertical diameter of which is equal to the stroke of the engine, and the greatest horizontal diameter of which is equal to $\frac{H A}{H K} \times$ stroke of the engine. The end C describes an arc of a circle about D as a centre, an intermediate point B of the rod A C describes, therefore, another oval curve, the greatest vertical diameter of which is approximately $\frac{B C}{A C}$ times the vertical traverse of A, while its horizontal diameter is approximately equal to the horizontal traverse of A, that is, equal to $\frac{H A}{H K} \times$ stroke. A lever B E F has one end jointed to B, the other end actuates the slide rod by means of the slide connecting rod F G, while the fulcrum E is constrained to move in a circular arc by being suspended to a pendulum link. The direction of the constraining arc is varied in a similar manner to that adopted in Marshall's system.

The motion of the slide is thus similar to that produced by Marshall's system, that is to say, it is such as might be obtained by the combination of the motion produced by an eccentric situated opposite to the crank, having an eccentricity equal to $\frac{E F}{E B} \times \frac{B C}{A C} \times$ crank, with that produced by an eccentric situated at right angles to the crank, having an eccentricity which is variable, according to the position or inclination of the arc in which the fulcrum E is compelled to swing, and which may be reversed in direction by suitably fixing the position of the arc. By means of the latter or variable part of the motion various grades of expansion are obtained, as also is the astern motion, precisely in the same way as in Marshall's system.

Fig. 16 shows the actual motion produced by Joy's gear. It is seen that in this gear the lead is constant, and also that the curves representing the motion are very approximately circular.

In the valve gears introduced by Messrs. A. C. Kirk and A. D. Bryce-Douglas, the similarity of the motion produced to those produced by the gears already described is easily seen. In the former, shown in Fig. 21, page 123, and in two of the gears by the latter, shown in Figs. 22 and 23, page 123, the motion is transmitted to the valve from a quadrant which oscillates about a point situated on the air pump lever, or on a lever similarly worked. The motion of the valve is thus compounded of the motion of the lever and of the oscillation of the quadrant. The first part is directly proportional to the motion of the piston, and is, therefore, such as would be produced by an eccentric situated opposite to or radially with the crank according to the side of the lever gudgeon to which the quadrant fulcrum is attached. The oscillation of the quadrant is produced by different means in the three gears, but in each case it is nearly proportional to, and is synchronous with, the horizontal movement of the point in the connecting rod from which the motion is first derived. Its effect on the valve is, therefore, approximately the same as might be produced by an eccentric placed at right angles to the crank, with a throw proportional to the distance to which the end of the slide connecting rod is moved from the fulcrum of the quadrant. By moving the slide connecting rod to the other end of the quadrant, the direction of this part of the motion is reversed, and a motion suitable for going astern is obtained.

In Figs. 17, 18, and 25 are shown in a similar manner as in the previous cases, the curves representing the resultant valve motion produced by these gears for astern, full-ahead, and intermediate degrees of ahead gear.

In another gear, shown in Fig. 24, page 123, introduced by Mr. A. D. Bryce-Douglas, an eccentric is fixed to the shaft in such a position that its dead points are at 90° from those of the crank. The end of the eccentric rod is constrained to move in a circular arc, the position of which admits of variation. From the end of the eccentric motion is transmitted by a link and a bell crank lever to the fulcrum of another lever, one end of which is attached to the slide connecting rod and the other end to the piston rod crosshead. The motion of the slide is thus compounded of a motion obtained from the piston rod with one obtained from the eccentric. By suitably altering the position of the constraining arc the amount and direction of the latter can be varied, and different degrees of expansion obtained. Fig. 26 shows the actual slide motion produced by this form of gear.

Although the main features of the motions produced by all these gears are alike, yet the slight differences produced by the obliquities of the rods, etc., are in some cases important, as they affect the motion at some of the critical points, such as at the instants of opening and closing of the steam and exhaust ports; they also affect the extent of openings of these ports when the valve is at the extremities of its travel. These influences can be seen by comparing the valve motion curves with Zeuner's valve circles.

Perhaps the most important of these differences is seen in the case of Stephenson's link motion, when comparing the gears with *open* and *crossed* rods, the differences being especially noteworthy in engines in which short eccentric rods have to be used.

In all cases of the gears examined in this Paper, "linking up" for cutting steam off earlier is accompanied by a diminished valve travel, and, therefore, by a contracted port opening; and because the speed of the engine is not reduced in the same proportion as the port opening, it follows that the velocity of steam through the ports when "linked up" is always greater than when working with full link, and consequently the wire drawing is greater also. If Figs. 7 and 8, page 121, be compared with Fig. 6, it will be seen that for the same relative cut-off when "linked up" with the two gears, that with *open* rods gives a greater port opening and, therefore, withdraws the steam less than that with *crossed* rods. It is this peculiarity which causes the *open* system to have the preference. On the other hand, we see that with this gear "linking up" increases the lead and very considerably advances the position of the crank at which the port opens first to steam, causing with high degrees of expansion a looped indicator diagram, whilst with the *crossed* rods the *lead* becomes less with the high degrees of expansion, and the position at which the port opens is not nearly so much advanced as with the other system.

In Marshall's gear it has been noticed that the substitution of the pendulum link for the straight guides of Hackworth's system causes a difference in the mean inclination of the curved paths of the constrained point, and renders the top and bottom portions of the valve's travel unequal. This is usually remedied by constructing one end of the valve with an extra steam port.

In both these gears the lead is usually made constant for all positions of "linking up," but it may be, and sometimes is, slightly varied by altering the position of the eccentric from being exactly opposite to, or in line with, the crank. In Joy's, Kirk's, and two of Bryce-Douglas's gear, the lead is always constant, the motion being derived from the connecting rod, and being, therefore, the same as would be derived from an eccentric exactly in line with the crank.

In considering the motion of valve gears, it is important to bear in mind the effect which may be produced in the motion by the want of adjustment occasioned by wear and tear. Looked upon

in this light, the effect of undue wear may be far more important as regards economy than any question of the cost of repairs to the gear, as a faulty motion may involve a direct loss of useful effect, and, therefore, a direct pecuniary loss during each revolution of the engine.

In Stephenson's link motion there are eight sets of wearing surfaces subject to motion during the running of the engine, viz., two eccentrics, two eccentric rod ends, the sliding of link block in the link, the rotation of link block in the eye of the slide valve, and the two ends of the drag links. The effects of wear upon this gear are well understood. That of the eccentrics and eccentric rod ends is to shorten the effective length of the eccentric rods and so to lower the slide, thus virtually increasing the lap at the lower edge and lessening that at the upper edge. This, so far as one eccentric is concerned, may be remedied either by lining up the eccentric rod to make it the same length between the centres as before, or by merely raising the valve on its spindle. The latter is usually the easier done, but unless both eccentric rods have worn to an equal extent, this method throws the gear out of adjustment not only for going astern, but also for working "linked up."

In Hackworth's gears there are only five moving parts subject to wear, viz., the eccentric, the two ends of the slide connecting rod, the sliding or guiding blocks of the fulcrum, and the joint of the lever with the sliding block. In Marshall's gear the number of parts are the same, the two latter being replaced by the ends of the pendulum link doing the same work. These ends are more easily kept in order, and more easily adjusted than the sliding block. The effect of wear upon the slide connecting rod and pendulum link is to shorten each of them. In the case of the former it lowers the valve, and of the latter it somewhat raises it; in both cases the effect is the same for all positions, ahead or astern of the gear, so that an adjustment, whether made on the rods themselves or on the slide spindle, if correct for one position is correct for all. The effect of wear of the eccentric is slight.

In Joy's gear there are eight wearing parts in the gear proper, in addition to the top and bottom ends of the connecting rods, making ten in all, in which wear, affecting the valve motion, takes place. In order to keep the valve motion correct, the shortening of the connecting rod, due to wear, must be corrected at *both* ends, not at *one* end only, as is usual when its effect on the clearance alone is considered, and a small amount of wear in the connecting rod, which might be disregarded if it were not for the valve gear, must be at once allowed for. The wear of the pendulum link D C must also be compensated for to preserve the proper motion of the point B. The effect upon the motion, caused by the wear of other parts of this gear, will be the same as in the second form of Marshall's gear, to which this part of Joy's gear is similar.

In Bryce-Douglas's and Kirk's gears there are still more wearing parts, the want of adjustment of each of which will more or less affect the resultant motion. Speaking generally, the wear of some of these parts will affect the ahead and astern motion to the same extent and in the same direction, while the wear of other parts will affect these motions in opposite directions, so that in making adjustments of these gears, it will in general be necessary to adjust each of the several parts of the gear.

In comparing one gear with another, however, it must be borne in mind that it is not sufficient to take into account only the number of the working parts involved, but due consideration must also be given to the loads coming upon the various parts, as these, of course, considerably influence the amount of the wear. As an illustration of this, the two forms of Marshall's gear may be taken. In each of these gears the number of working parts is the same, but the loads on the parts are very different, as may be seen by referring to Figs. 19 and 20. In Fig. 19, if A B be the position of the pendulum link, B C that of the lever in its extreme position, and D E the direction of the slide rod, it is evident that for any given load on the slide rod the load on the eccentric sheave must have a direction passing through E, and the loads on A B, D E, and on the eccentric in the direction of C E, must be in equilibrium; hence, if we draw B F parallel to C E, the lengths of F E, B F, B E, will be proportional to the loads on the slide rod, eccentric, and pendulum link. In this way it is seen that, taking the load on the slide rod to be unity, that on the pendulum link will vary between 1·1 and ·65 for the go-ahead position, and from ·73 to ·83 for the go-astern positions; while that on the eccentric varies from ·55 to ·89 when going ahead, and from ·49 to ·82 when going astern.

Applying the same method to the other form of gear, in Fig. 20, we find that the loads on the pendulum links vary from 1·4 to 2·4, and on the eccentric from ·5 to 1·5 times that on the slide rod; so that in this form of gear the loads are more than twice as great as in the other, and unless the wearing surfaces are increased in the same proportion, the amount of wear must be much greater.

As was pointed out in the beginning of this Paper, it is impossible to fully deal with all points in connection with these gears in the limit of one Paper, and it is impossible also to describe all the methods which have been used and proposed for working slide valves. It will, however, be found that in most of the gears the motion really is derived from that of two moving parts, and that the variations of motion giving the variations of expansion are produced by combining these in different proportions.

In concluding, it should be mentioned that since commencing this Paper the attention of the writer has been drawn to a pamphlet published at Paris last year by Monsieur A. Madamet, in which this subject has been treated in a somewhat similar manner.

THE SCOTIA ENGINE WORKS, SUNDERLAND.

THE splendid range of premises known as the Scotia Engine Works, and situated on the south bank of the Wear, nearly opposite the Palmer's Hill Works, are now so nearly completed that a commencement of business operations may be looked for in the course of a few weeks. The building is not wholly new, the central portion having been erected in 1881 by Messrs. Carr & Co., who carried on the business of marine engine and boiler building there during the prosperous years which followed the date of opening, and again for a short period which terminated early in 1887. The place soon afterwards passed into the hands of the present owners, the chief of whom is Mr. William Allan, who for twenty years was engineer-in-chief to the North-Eastern Marine Engineering Company, and under whose management that Company's success was unequalled. In the hands of this eminently practical and experienced gentleman the place has assumed quite a new aspect, and apart from the great extensions carried out has been made in every way more convenient and better adapted for the economical manufacture of marine engines and boilers. A piece of waste ground which was situated at the east end of the original building has been made the site for a handsome range of offices, as well as for smiths' shops, pattern shops, stores and other buildings, and the premises which formerly were used as offices at the west end of the building have been replaced by an additional wing, which constitutes an important extension of the main building in which the manufacture of engines, &c., will be carried on. Not the least of the changes that have been made is the erection of a spacious jetty, running the whole length of the works, and extending to a sufficient distance on the river to admit of large steamers coming alongside. At a suitable point on this jetty a powerful crane will be placed, whose lifting capacity will be quite equal to any calls that are ever likely to be made upon it. On the whole, it may be said with perfect truth that the Scotia Engine Works when started will deserve to rank among the leading engineering establishments of the north, and if exact fitness in every detail of the arrangements for the special tasks to be performed constitute a fair groundwork for the achievement of success, then in this case there is excellent reason for those who are most nearly interested to take a hopeful view of the future. We will have pleasure in reverting again to this establishment, and giving a more detailed account of dimensions and equipment.

A PATENT stern wheel hopper dredger, of 500 tons capacity, is to be constructed by Messrs. Simons & Co., Renfrew, for the Natal Harbour Board, in connection with the dredging operations at the port of Durban, for which work it will be specially designed. It is to be fitted with the builders' traversing bucket ladder, adapted to work through an opening at the stern.

ACCORDING to Professor R. H. Thurston, there are three great chances left for inventors, viz., the production of electricity directly from the combustion of coal or similar fuel; secondly, the production of light without heat, as in the case of the light of the fire-fly and that of the glow-worm; and thirdly, the production of a successful air-ship.

ON THE COMPARATIVE MERITS OF DEEP KEEL AND CENTRE-BOARD YACHTS FOR RACING PURPOSES.*

By B. MARTELL, Esq., Chief Surveyor, Lloyd's Register of Shipping, Vice-President.

THE late successes of American yachts fitted with centre-boards when competing with deep-keel yachts of the British type have been so striking as to produce an opinion amongst many yachtsmen that yachts of the American design have, in every respect, superior qualities to the deep-keel vessels, and that they will ultimately supersede the latter description of yacht for racing purposes. Under these circumstances the subject of the comparative merits of these different types has been thought sufficiently interesting to examine into the qualities alleged to be due to each type of vessel; and the object of this Paper is to place before professional and yachting men the results of such investigation with a view to eliciting a discussion amongst those who can claim to speak with authority on this question, more particularly in a locality where so much enterprise and enthusiasm have been displayed in this interesting subject.

I had hoped to have obtained for this purpose drawings of the celebrated yachts *Thistle* and *Volunteer*, in order that an exact comparison might have been made of several of the noteworthy features of these yachts; but in this I have been unsuccessful, and have had to content myself with plans kindly prepared by Mr. Mares in my office from various sources of information, which represent very closely these yachts, and are sufficiently near for instituting the comparisons in question.

The following are the particulars of the two types of yachts:—

	Thistle. Ft.	*Volunteer.* Ft.
Length on water-line	85·6	85·7
Breadth, extreme	20·0	22·2
Depth (moulded)	17·0	13·5
Draught of water	13·5	10·0
Displacement in tons	150	130
Freeboard	3·5	3·5

From these particulars it will be seen that the principal difference in the yachts is the relation of depth to breadth.

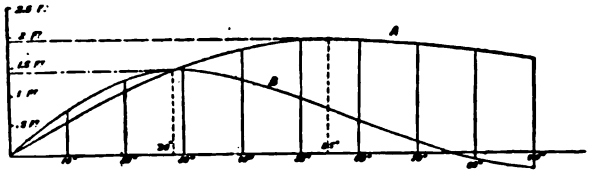
In our own yachting circles the tendency for some years has been in the direction of decreasing the beam, and to acquire the necessary displacement by increasing the draught. The loss of stability initially, and indeed at all inclinations at which yachts usually sail, resulting from decrease of beam, has been compensated for in practice by carrying large quantities of ballast, amounting in some instances to more than the weight of the hull, spars, and equipment combined. This diminution of breadth has been carried out of late years to an extent which many experienced yachting men have regarded with disfavour. The tendency no doubt has been fostered by the retention in the minds of many of the erroneous ideas upon the subject of resistance prevalent for many years, and which led to the construction of comparatively narrow and unsafe vessels for general mercantile purposes. Our knowledge of the resistance of ships which we owe to the patient investigation of the late Mr. Froude and his son, scant though it be, is sufficient to show that increase of beam is not necessarily associated with increase of resistance. As soon as that fact in connection with other advantages which breadth gives became sufficiently impressed upon men's minds, a rapid change in the proportions of vessels built for the Mercantile Marine at once took place. The same change, however, has not taken place in the design of British yachts. Perhaps to some extent, in addition to the foregoing considerations, this was owing to the tonnage rule under which yachts, until recently, were sailed. This rule did not take cognisance of depth, and no restriction, therefore, was placed on its increase to any extent which might be considered advantageous.

Our Transatlantic kinsmen, who were not hampered by such tonnage laws, have, on the other hand, placed confidence in breadth of beam and shallow draught, it being apparently their opinion that a vessel of that type would "skim" over the water, instead of having to "plough through it," as in the case of the deeper draught vessel of the narrow type. They long ago, however, discovered that such vessels, without artificial means of preventing leeway, were not superior to, if as good as, those having a greater hold of the water. Hence the introduction of the centre board.

Having thus cursorily traced the growth of the two types of yachts, I propose discussing briefly some of the advantages which they independently possess. Breadth of beam is essential to initial stiffness, if stiffness is to be secured by form alone, or even by form mainly. The narrow deep yacht has necessarily a low position of the metacentre, and an adequate interval between the metacentre and the centre of gravity can only be secured by artificial means—that is to say, by the use of a large quantity of ballast. The shallow, broad yacht, on the other hand, possesses initial stiffness due to form alone, and although ballast is carried in these vessels also, it is not required to anything like the same extent, and is useful mainly in lengthening out the *range* of stability. As a matter of fact, therefore, the one yacht is able to stand up under her canvas in a breeze with a small amount of ballast by reason of the stability due to her form, while the other cannot do so without the aid of a large quantity of ballast. As regards this feature of initial stability, which is of the utmost importance in racing yachts, since it practically determines the area of sail to be carried, there is, in my opinion, no doubt that the advantage is on the side of the broad shallow vessel. Initial stability can be gained more easily and more rapidly by increase of beam than by increase of ballast. The *Thistle* has doubtless considerable initial stability, and carries a comparatively great spread of sail; but she must be regarded as a compromise between the two types, and scarcely representative of either.

The broad yacht can usually carry at the same inclination, in the same breeze, larger quantity of sail than the narrow, ballasted yacht of the same length and same area of immersed section; or, if both be provided with the same spread of sail, she will stand up better under her canvas, and thus have her sail area more advantageously disposed for receiving the wind's pressure. And this is so at all inclinations at which yachts are usually sailed.

With a view to comparing the *Thistle* and the *Volunteer* in this respect, the stability has been estimated from the drawings referred to, ranging from the upright condition to 90° inclination, when the vessels would be on their beam ends; and the curves marked A and B in Fig. 1 give the results of these calculations.



In estimating the centre of gravity of the vessels, each is assumed to have masts, rigging, and sails of the total weight of 10 tons. The weight of the hull of the *Volunteer* is taken as 60 tons, and that of the *Thistle* as 70 tons, and ballast has been added to make up the computed displacement, viz.: 60 tons in the *Volunteer*, including centre-board and fittings, and 70 tons in the *Thistle*. The centre of gravity of each of these items is taken, for the purpose of comparison, at a corresponding height in each vessel. The metacentric height in the *Thistle* is thus found to be 3·2 ft., and that of the *Volunteer* 4 ft.

From these curves it will be seen that at all moderate angles of heel, the advantage is considerably on the side of the *Volunteer*. This vessel, however, reaches her angle of maximum stability at about 28°, and beyond this the moment of stability continuously decreases until the angle of about 76° is reached, when the stability vanishes. The *Thistle* on the other hand, although possessed of less stability at small angles of heel, does not reach her maximum stability until about 55° of inclination, and at 90° she has still a large righting moment. Such a vessel is of course uncapsizeable, while it is questionable whether the *Volunteer* could be considered safe for an oversea voyage, subject to the sudden gales which might be encountered; or at least if a race were sailed in the open sea in bad weather, whether it would not be considered prudent or necessary to reduce the sail spread in weather in which the *Thistle* would carry all her plain sail with perfect safety.

Passing from the consideration of stability or ability to stand up under canvas, we come next to the important question of leeway. Running before the wind the British yacht is quite as fast as the American of the same size, if the spread of canvas be as great. The records appear to show that the *Thistle* was even superior to the *Volunteer* in this respect; but, of course, in judging of this, it must be borne in mind that vessels separated by a

* *Read at the Summer Session of Naval Architects, Glasgow, July 24th, 1888. The Right Hon. the Earl of Ravensworth, President, in the Chair.*

considerable distance may be subject to great differences in wind pressure, which would possibly account for the *Thistle* gaining slightly on the *Volunteer* on returning in the second race. This point is referred to further on.

If area of middle line longitudinal plane only be considered as a measure of the resistance to leeway, the cause of the superiority of the American vessel will not be evident, as this would appear to be practically the same in the two vessels, viz., 853 sq. ft. in the *Thistle*, and 856 sq. ft. in the *Volunteer*, including the centre board. As, however, a vessel when making leeway would be under a wind which would cause her to heel, it follows that the vessel which can stand up best will have an advantage over the less stiff one.

The effective lateral resistance is usually estimated from data obtained from the experiments of the late Colonel Beaufoy, on the assumption that the resistance varies as the square of the sine of the angle of inclination of the middle line longitudinal plane to the horizontal.

The late Mr. W. Froude, however, investigated this subject, and stated at the Institution of Civil Engineers in 1871 that this assumption was not correct. At the same time he gave a curve showing for each angle of inclination the value of the resistance per square foot at a given speed. By means of these data the effective lateral resistance of these two yachts has been calculated thus:—

The vessels are supposed to be under the influence of a wind which, with the same spread of sail, heels the *Volunteer* 15°, and the *Thistle* 16½°. The outline of each transverse section is then divided as shown in Fig. 2, into several parts, and the mean angle of inclination of each part to the horizon is measured. The

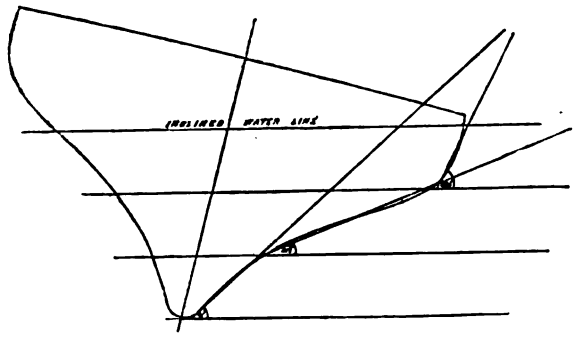


Fig. 2.

effective resistance of each of these lengths is then estimated from the data above referred to, and by the usual method these resistances are integrated throughout the length of the vessel. The results obtained by this process are as follows:—

Thistle.—Resistance equal to that due to a plane area of 780 sq. ft. placed at right angles to the line of advance.

Volunteer.—Ditto ditto ditto equal to a similar plane area of 768 sq. ft.

It may be remarked that the results obtained by the process explained would not be quite correct, in that the water set in motion by the upper part of the vessel, inclined at one angle to the horizon would undoubtedly affect the resistance of the lower part of the vessel inclined at a different angle, but it is considered that a very fair comparison may by this means be made of the relative resistance of two vessels of the same type.

The relative resistance to leeway thus calculated is slightly in favour of the *Thistle;* while, if the areas of the middle line planes are compared the vessels are seen to be practically the same. The cause of this slight falling off in the *Volunteer* is plain when the breadth and draught of the two vessels are considered; thus in the *Volunteer* $\frac{\text{breadth}}{\text{draught}} = \frac{22{\cdot}2}{10} = 2{\cdot}22$ and in the *Thistle* it is $\frac{20}{13{\cdot}5} = 1{\cdot}5$ nearly. The *Thistle* thus presents her side far more square to the direction the vessel is being driven, and were it not for the centre-board of the *Volunteer* she would undoubtedly drift to leeward much more quickly than the *Thistle*, as may be seen from a comparison of the figures calculated as above, with and without the centre-board, viz., the area of the middle line plane without the centre-board is 732 sq. ft., and of the centre-board 124 sq. ft., or a little over 16 per cent. of the whole, while the effective area for resistance to leeway, calculated as before explained, of this vessel without centre-board is only 634 sq. ft., and of the centre-board 134 sq. ft. or 21 per cent. of the whole, showing clearly the effectiveness of the centre-board.

The cause of the greater resistance to leeway undoubtedly possessed by the *Volunteer* must, however, be accounted for by the fact referred to by Mr. Froude in the discussion on the paper alluded to, that the *leading part* of a plane moved obliquely through a fluid has a much greater resistance per square foot than the remainder of the plane. This greater resistance is also referred to by Mr. Dixon Kemp, in his valuable treatise on "Yacht Architecture," and would appear to be owing to the leading part of the plane being continually brought into contact with fluid at rest, while the remainder of the plane acts on fluid already in motion. It will readily be seen that the triangular centre-board of the American yachts, having a long leading edge, is most advantageously placed in this respect, and its resistance per square foot at a given speed is much greater than that of the ship proper.

Turning now to a consideration of the means of propulsion of yachts, it appears to be a well-established fact that American sailmakers have for a long time made their sails much flatter than is the practice in this country, and, further, that the advantage of doing so is so far recognised in this country that suits of sails are now frequently ordered in America for British yachts.

In the diagram, Fig. 3, suppose A B to be the horizontal section of a jib, P the direction of the wind relative to the vessel, and suppose the sail under the influence of this wind to assume the shape indicated by the dotted line A B C, this wind pressure produces a tension on the material of the sail which acts on both the stay at the fore edge and the bolt-rope at the after edge. The tension on the after edge is a propulsive force, while that on the forward edge is a retarding force, and the excess of the resolved part of the latter above the resolved part of the former, in a fore and aft line, is the net effective force of the sail. Now, it appears from observation that the ballooning is found nearer the forward than the after edge, and consequently, when the vessel is sailing with the wind not greatly before the beam, the retarding force R_1 acts as a greater angle to the fore and aft line in a balloon sail than in a flat sail, and the effective force of the wind on the sail is thereby increased.

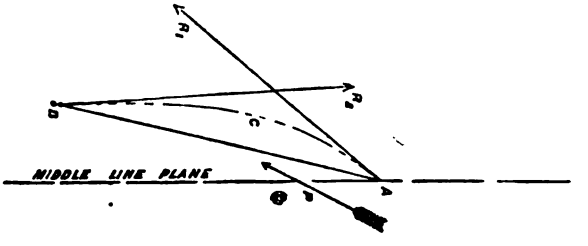


Fig. 3.

The late Mr. Froude, at the Institution of Civil Engineers, in the discussion previously referred to, mentioned cases where the rounded cut of the luff of a jib produced a bagginess just abaft the stay, which swelled out under the influence of the wind so much that the "bag" could be seen on the fore side of the stay by an onlooker standing square to the vessel's course.

In such a case the sail's action on both stay and bolt-rope is propulsive; but it is evident such a sail would soon "lift" if the vessel were forced close to the wind, owing to the wind pressure on the back of the fore part of the sail being at least equal to that on the fore side. Indeed, it is evident from a consideration of the diagram that when the vessel is sailing close to the wind any considerable amount of ballooning of the sail will cause the fore part to be parallel, or nearly so, to the direction of the wind, when its propulsive effect would be lost, while the after part of the sail standing across the wind will tend to form a back sail.

The conclusion appears to be that if the vessel is not sailing very close to the wind the advantage lies with the balloon sail; but if it is necessary to press the vessel close to the wind, a very distinct advantage is gained by having flat sails, which, by avoiding any back pressure, get the utmost effect out of the wind.

As regards the resistance to propulsion of the two vessels, the wetted surface of the *Thistle*, calculated from the plans alluded to, appears to have been about 2,160 sq. ft.; and of the *Volunteer* 1,980 sq. ft., not including the centre-board, and 2,230 sq. ft. with the centre-board. If anything, the frictional resistance per square foot of surface would, from the result of Mr. Froude's

experiments, be somewhat less in the *Thistle* than in the *Volunteer;* further, at low speeds the wave-making resistance would be in favour of the *Thistle*, and not until very great speeds were reached, at which the formation of transverse waves begins, would the *Volunteer* reap any advantage over her narrower rival.

In the second race between the *Volunteer* and *Thistle* they had to beat out 20 miles in the teeth of the wind, and, apart from the possibility of the wind blowing with different force on sails separated by a considerable distance, the results of this race present on analysis some interesting features. It is estimated that in the run out the *Volunteer* covered a distance of 27 miles in 3h. 45m. 50sec., while the *Thistle*, owing to the greater leeway made, sailed about 29 miles in 4h. 0m. 39sec. The mean speed of the *Thistle*, from these figures, was 0.8 per cent. greater than that of the *Volunteer*.

In returning the yachts sailed each 20 miles, the *Volunteer* in 1h. 57m. 7sec., and the *Thistle* in 1h. 54m. 12sec., giving the advantage of 2·5 per cent. in speed in favour of the *Thistle*. Now, in the run out the *Volunteer's* centre-board would be lowered, thereby increasing the surface friction, and in the return this cause of resistance would not occur; and yet in spite of this the *Thistle* increases her advantage by about 1·7 per cent. of the speed. Further, the wave-making resistance at the high speed of the return journey could not, as previously explained, help the *Thistle* as compared with the *Volunteer*, and consequently the greater portion of this difference must be accredited to the flatness of the *Volunteer's* sails in beating out against the wind. Of course, on the results of one race it is impossible to form a decided judgment, but the evidence in this case markedly points to this conclusion.

And here it may be remarked the great advantage which has been derived by the naval architectural profession from the experiments made by the late Mr. W. Froude, and continued by his son, and seeing that Professor Jenkins assisted in conducting many of these experiments, I feel sure that I am only expressing the wishes of all here present when I venture to hope that the time is not far distant when Glasgow University will possess an experimental tank, where the students may conduct similar experiments, guided by the sound judgment of the Professor of Naval Architecture at the University, when many of the doubts which now exist in dealing with such subjects as this will be solved, and surer advances in the profession be attainable.

I feel at the same time much pleasure in acknowledging the assistance I have derived from my friends Professor Jenkins and Mr. T. C. Read, of Lloyd's Register, in preparing this slight review of an interesting subject.

In conclusion, I have only to add that in summing up the results of this brief investigation, it would appear that the American type of yacht possesses greater stiffness, and therefore greater sail-carrying power; it has, by reason of the centre-board, greater resistance to leeway, is fitted with better sails for close-hauled sailing, and has practically no more skin friction and wave-making resistance at all ordinary speeds, while the only point on which the British type has the advantage is, that she is safer in bad weather in the open sea with a large spread of canvas. It is not surprising that under these circumstances all the recent trials of speed between the British and American types should have resulted in the triumph of the latter. It now behoves British yachtsmen to consider whether it is expedient for them to make sea-going qualities a *sine qua non* in a racing machine, or to sacrifice high speed in bad weather at sea in order to obtain greater speed in the usual conditions under which these vessels will be raced, which is, after all, the principal reason of their existence.

THE second solid steel armour plate entered for competition against compound plates has just been fired at on board the *Nettle* at Portsmouth. It was manufactured by Sir John Brown & Co., Sheffield, and was of the specified dimensions of 8 ft. by 6 ft. and had a thickness of 10 in. The attack was from the 6 in. breech-loader; five rounds at 30 ft. with 42 lb. charges, two of the projectiles being ordinary Palliser shot, and three Hollzer solid steel shots. The Pallisers were completely broken up. One of the steel projectiles, the first fired, aimed at the bottom right hand corner of the plate, not only completely penetrated it, but buried itself nearly two feet in the bulkhead at the rear, and the second shot directed at the centre of the plate, just went through the base, being about 10 in. from the surface. The third round, as it was fired with greater obliquity, inflicted less damage.

THE INSTITUTION OF NAVAL ARCHITECTS.

SUMMER MEETING AT GLASGOW.

NUMEROUS bodies, scientific and otherwise, have this year selected Glasgow for their place of meeting, attracted doubtless by the International Exhibition of Science, Art, and Industry organised in the beautiful Kelvingrove Park of that city. This selection has in no case been made with so much justification and propriety than in connection with the Institution of Naval Architects. The present year is the centenary of the birth of steam navigation on the Lake of Dalswinton, Dumfriesshire, and the Clyde is the cradle in which the puny and unpromising infant was nursed into vigorous and healthy youth, and the sphere in which the youth has grown and developed into a most useful and glorious manhood. In the visit of the Institution to Glasgow, therefore, there is, as the noble President, Lord Ravensworth, said, in his opening address on Tuesday, the 24th ult., "peculiar significance and propriety." "The occasion and the place," he continued, "seemed to be strictly in accord, when they remembered that this was the centenary of steam navigation, and when they remembered the leading part that the shipbuilders, engineers, and mechanics of Glasgow and the Clyde from the outset took, and up to the present day had maintained in that rapid development." The visit extended over four days, Tuesday 24th to Friday 28th inclusive, the last day, and the afternoons of other days being devoted to excursions to places of industrial or scenic interest in the neighbourhood of Glasgow.

This visit was the second one of the kind which the Institution has paid to Glasgow; indeed the practice of holding summer meetings originated with one in Glasgow during midsummer 1877. On that occasion the visit was made on the invitation of the Institution of Engineers and Shipbuilders. The late Lord Hampton, better known as Sir John Pakington, was the then president, and amongst other distinguished authorities present were the late Mr. Scott Russell, the late Mr. Samuda, and Sir E. J. Reid. On the completion of the arrangements for holding the International Exhibition during the present season in Glasgow, a proposal was made to again invite the Institution to the city. It was at once and most heartily taken up, not only by the Institution of Engineers and Shipbuilders, but also by kindred bodies—the Clyde Steamship Owners' Association and the Clyde Sailing Ship Owners' Association. The Town Council of Glasgow on being approached also promised cordial co-operation, and on intimation of the acceptance of the invitation being received, a large and influential local committee was appointed, who made such arrangements as at once gave promise of perfect success. The meetings commenced on Tuesday, 24th ult., at ten o'clock, and when the hour of adjournment, 1 o'clock, had arrived, the weather was everything that could be desired for the excursions that had been arranged, viz., one to the Forth Bridge Works and one to the Harbours and Docks of Glasgow on the invitation of the Clyde Navigation Trustees. The place of meeting was the Corporation Galleries in Sauchiehall Street, kindly granted by the City authorities, and the visitors were received by the Hon. Sir James King, LL.D., Lord Provost of Glasgow, by the Council of the Institution of Engineers and Shipbuilders in Scotland, the Directors of the Clyde Steamship Owners' Association and the Clyde Sailing Ship Owners Association, and other members of the Reception Committee. There was a goodly number of local shipbuilders, owners, and engineers present at the opening meeting, which would number altogether about 350 to 400, but the majority consisted of members and visitors from a distance. Amongst those better known to the shipbuilding and engineering profession we noticed Admiral Sir John Dalrymple Hay; Mr. W. H. White, Director of Naval Construction; Mr. A. C. Kirk, LL.D., of Messrs. Napier and Sons; Mr. F. C. Marshall, of Messrs. Hawthorn, Leslie & Co.; Mr. Peter Denny, Dumbarton; Mr. H. H. West, Liverpool; Professor Jenkins, Glasgow University; Professor James Thomson, Glasgow University.

Following upon the ceremony of reception, the President of the Institution, the Right Hon. the Earl of Ravensworth, took the chair, and after acknowledging the cordial reception which had been extended to the Institution, proceeded to refer to the fact of this year being the centenary of steam as a motive power in ship propulsion. "There was one remarkable feature," he said, "which always struck him in the early stages of the development of that mighty industry which had probably done more than any

other industry he could name to spread commerce and civilisation —and the two terms were almost identical—into the remotest parts of the known world. The start was made in Glasgow, and what he wished to call attention to was that from the outset they found the Scotch lords and Scotch lairds going hand in hand with the engineer, the shipbuilder, and the mechanic in that development. It was in 1787 that Mr. Miller and Mr. Symington constructed the first boat propelled by paddle and steam. A little boat—it was only a pleasure-boat—was launched upon the waters of Dalswinton Loch, and he believed that under favourable circumstances—the smooth surface of the loch—she attained a speed of five miles an hour. If they compared that performance with the *Etruria* last week, which b at the record from New York, making the voyage in six days one hour and fifty minutes, they would find that the average was 19·34 knots per hour during the whole voyage. (Applause.) He merely alluded to this to compare that performance with the five miles per hour upon the little inland loch, and they saw, in a rough-and-ready way, a certain gauge of progress of steam navigation during the century of which he had spoken. (Applause.) But there was a vessel which, if she fulfilled expectations—he meant the *City of New York*—(applause)—with the sister vessel being built, would prove extremely formidable rivals to those greyhounds of the sea they had known so many years—the *Arizona*, the *Alaska*, the *Umbria*, and the *Etruria*. He only alluded to these things in order to justify him in claiming, as he was about to do, the proud title for Glasgow and the Clyde of being at one and the same time the birthplace, the cradle, the nursery, and the high school of steam navigation. (Loud applause.) After referring to the Tyne as likely to be a rival to the Clyde in the construction of the joint fleets of the country, he spoke of the names associated with steam navigation on the Clyde—particularly Robert Napier, George Burns, John Burns, John Elder and Alex. Kirk." His Lordship concluded by referring briefly to the papers to be read at the meetings, and the programme of excursions, &c. In connection with "Our Recent and Projected Improvements on the River Clyde," by Mr. James Deas, C.E., the Engineer to the Clyde Trust, he read a telegram from that gentleman saying that he had been called unexpectedly to London to give evidence on the Glasgow Central Railway Bill.

The first paper read was one by Mr. Benjamin Martell, Chief Surveyor Lloyd's Register of Shipping, "On the Comparative Merits of Deep Keel and Centre-Board Yachts for Racing Purposes," which, as it will be found *in extenso* in another page, we need not attempt to describe. Mr. G. L. Watson criticised Mr. Martell's paper, and communicated some important particulars as to the two late competitors for the American Challenge Cup, the *Thistle* and *Volunteer*. Mr. W. H. White, Prof. Jenkins, Captain Fitzgerald, and others continued the discussion, after which Mr. Martell replied, and a vote of thanks was awarded to that gentleman by the meeting.

The paper by Mr. James Deas, C.E., was then read by Mr. Deas, jun., in the absence of his father. The author gave an account of the improvements which within the comparatively short time of 88 years had raised Glasgow from a second-rate inland town, with a population of 77,000, to be the second city of the empire, with a population, including its suburbs, of 770,000. He stated that up till 1768 the river between Glasgow and the sea remained practically in a state of nature. At the present time the depth of water in the harbour was from 25 to 29 feet. Before 1818 none of the vessels in the foreign trade (the largest would not exceed 400 tons) came further up the river than Greenock or Port Glasgow. Now steamers of 16 feet draught left Glasgow and Greenock respectively at any state of the tide. In 1856 there were only 12 vessels belonging to the merchants of the port. Last year Glasgow appeared from the Board of Trade statistics to be the third largest shipowning port in the kingdom, with 1,487 vessels of an aggregate tonnage of 1,141,037. The total gross revenue of the Clyde Trust from 1752 to 1887 amounted to £7,167,281, and the gross expenditure for the same period to £11,622,950; while the Trust at the latter date had a debt of £4,506,656. So far as depth of water was concerned, shipbuilding was always possible at Dumbarton, Port Glasgow, and Greenock. By 1839 four shipbuilding yards had been established within the limits of the present harbour. There were now 43 shipbuilding yards in the Clyde district.

On the motion of Sir John De Hay, seconded by the President, a vote of thanks was passed to Mr. Deas for his paper.

The proceedings for the day then terminated.

The members afterwards divided into two excursion parties, the one proceeding by the North British Railway to inspect the Forth Bridge Works, and the other leaving Glasgow Bridge Wharf in a special steamer, on the invitation of the River Clyde Trustees to inspect the Glasgow harbour and works. The steamer—which was one of the harbour passenger steamers—*Cluthas* steamed to all the points of interest about the harbour, including the Queen's Dock, and the Trust's admirable graving docks on the opposite side of the river, and afterwards proceeded to the Trust's repairing works at Dalmuir. On the way, going and returning, the various shipyards and industrial works were scanned by an interested party. The wood sheathed gun-boat for the British Government presently on the stocks at Fairfield, and the twin screw steamer, *City of Paris*, on the stocks at Clyde bank shipyard, attracted especial attention. The weather was all that could be desired, and the run was much enjoyed.

The proceedings on Wednesday 25th consisted of the reading of three papers, "On Copper Steam Pipes for Modern Marine Engines," by Mr. W. Parker, Chief Engineer Surveyor Lloyd's Register of Shipping; "On the Course of Instruction in Naval Architecture at Glasgow University," by Professor P. Jenkins; and "The First Century of the Marine Engine," by Professor H. Dyer, after which the members visited the Exhibition by invitation of the Exhibition Ceremonials Committee. The Institution dinner took place within the Exhibition in the evening. Thursday's proceedings largely consisted of Council matters, the proposal and admission of members, and the reading of two papers, "Steam Trials of the Royal Italian Ironclad *Lepanto*," by Signor Nabor Soliani; and "On the Possible Effect of High Explosives on Future Designs for Warships," by Captain C. C. P. Fitzgerald. In the afternoon two excursions took place, one to the works of William Denny & Bros., Dumbarton, and the other to the works of the Steel Company of Scotland. Of these several papers and excursions we will have more to say in next issue. Friday was entirely devoted to an excursion in the famed river steamer *Iona* to the head of Loch Fyne.

SUMMER MEETING OF THE INSTITUTION OF MECHANICAL ENGINEERS.

THE members of the Institution of Mechanical Engineers have arranged to hold their summer meeting in Dublin this year, commencing on Tuesday, July 31st, a visit being paid to Belfast on Friday, August 3rd, the closing day of the meeting.

The Reception Committees include all the leading men of both districts, and we have no doubt but what the admirable arrangements made by the secretarial departments will ensure a most successful and enjoyable meeting for all concerned.

The following gives, in brief, an outline of the proceedings that will take place, some of which will be more particularly described in our next, in which we also purpose giving any of the papers that may prove of special interest to our readers.

On Tuesday, the opening day, the President (Edward H. Carbutt, Esq.), Council, and members will be received in the Examination Hall of Trinity College, Dublin, by the Right Honourable the Earl of Rosse, Chairman, and other members of the Local Committee. After this ceremony is over, the President will deliver his address, and the reading and discussion of papers will follow, the members being afterwards entertained at luncheon, in the Dining Hall of Trinity College, by invitation of the Local Committee. The whole of the afternoon of this day will be taken up by a trip in Dublin Bay on a special steamer kindly lent by the London & North Western Railway Co., to view the Alexander Basin, deep water quays, dredging operations, Bailey Lighthouse, and Kingstown. The Institution Dinner, in the Royal University of Ireland, by kind permission of the Senate, will close the opening day of the meeting.

On Wednesday, August 1st, the reading and discussion of papers will be proceeded with in the morning, and after again lunching in Trinity College Dining Hall, on the invitation of the Local Committee, two alternative excursions, each of which will occupy the whole afternoon, will be open to the selection of the members. Those selecting the first, will go by special tramcar from Trinity College, to visit the Great Southern and Western Railway Locomotive, Carriage, and Wagon Works, at Inchicore; while those members who patronise the second excursion will proceed also by special tramcars from Trinity College to visit the Rathmines Water Works; while for those who do not care to go so far afield, numerous works in Dublin—including Sir Howard Grubb's Optical and Mechanical Works; the bank-note printing machinery at the Bank of Ireland, etc., are open for inspection. A conversazione at the Royal Irish Academy by invitation of the

Local Committee, at whose disposal the Mansion House and gardens adjoining the Academy have been kindly placed by the Right Honourable the Lord Mayor of Dublin, will terminate the second day of the meeting.

Thursday will be devoted to visiting Messrs. John Power and Son's Distillery and Messrs. Guinness's Brewery, special tramcars running from College Green for the purpose. Some sixteen or more other works are also open for the inspection of the members on this day. At 7.15 p.m. a special first-class train will leave Amiens Street Station, Dublin, for Belfast.

On Friday, the last day of the meeting, the reception of the President, Council, and members of the Institution will take place at 9.30 a.m. in the Town Hall, by his Worship the Mayor of Belfast, Sir James H. Haslett, Chairman, and the other members of the Belfast Local Committee. At 10 o'clock the members will proceed to visit Messrs. Harland & Wolff's Shipbuilding and Marine Engine Works, and other works open for their inspection. Luncheon will be provided in the Town Hall by invitation of the Local Committee, and at 2.30 a steamer trip round Belfast Lough will enable the members to inspect the new docks, dredging operations, and New Island Lighthouse, a conversazione at 8 in Queen's College, Belfast, by invitation of the Local Committee, finishing the day, and closing what promises to be a most interesting and enjoyable summer meeting.

THE FRENCH TORPEDO BOAT "COUREUR."

IN our last issue we briefly noticed the launch, by Messrs. Thornycroft & Co., at Chiswick, of the torpedo boat *Coureur*, built by them for the French Government, and we now have much pleasure in giving herewith full particulars and drawings of the vessel and her machinery.

The *Coureur* is built on the same lines as, and may in fact be called a sister ship to, the *Ariete*, built by Messrs. Thornycroft & Co. for the Spanish Government, and which vessel attained last year, on the official measured mile trial on the Thames with a load of 17·35 tons on board, the remarkable speed of 26½ knots, a speed which we believe has not yet been equalled by any other vessel. The present vessel is 147 ft. 6 in. in length, with a beam of 14 ft. 6 in., and having a draught when loaded of 5 ft. The hull is constructed of galvanised steel throughout, and, as shown by the illustrations, is divided into numerous watertight compartments, twelve in all, which are fitted with steam ejectors for keeping them clear of water should the hull be damaged either by a collision or by projectiles. Of these twelve compartments all except one, that in the torpedo room, are carried up to the deck, the torpedo room bulkhead having its top well above the water line, while the general arrangement is such that any two compartments may be filled without sinking the boat. In order to facilitate communication, the bulkheads are pierced, completely watertight doors being provided.

As will be seen by reference to Fig. 3, the vessel is a high sided one, but of no great depth under water, the light draught, about 5 ft., loaded, being a favourable feature of the design.

Proceeding now to examine the different compartments from the stern, and working forward, we descend first into an exceptionally roomy compartment (for what in an ordinary vessel would be the after-peak), and where the steering engine is placed. The latter is novel in design, having two rudders placed alongside each other to operate, the handwheel being in the fore part of the boat. This steering engine, which is shown in outline in Fig. 4, has two horizontal cylinders actuating one crank shaft, the latter gearing with a shaft above by means of worm gearing. It will be seen by the engraving that the engine is placed diagonally with the line of the keel, and on either end of the shaft there is a worm. These worms, which are right and left handed, gear into suitable worm sections on the rudder stocks, which are prolonged so that the rudder heads can work in bearings fixed in the deck above. The rudders are of the suspended type, having no bearings below, and the arrangement described gives the necessary rigidity to the whole structure. The engine works both rudders at once, and the helm is held rigidly, the whole of the parts being made of ample strength to bear any blows from seas striking the rudders, each of which, taken alone, is of comparatively small area. The next compartment, entered by a separate hatchway, is devoted to the sanitary arrangements, and adjoining this is a compartment containing the lavatory, next which is the pantry. From here we pass to the main saloon, entered from the deck through the after conning tower, as shown, there being also an entry through the pantry. The saloon is 10 ft. 6 in. long by 11 ft. 6 in. wide (Fig. 5). The officers' cabins are at the sides of the forward part of the saloon compartment, the ladder by which the latter is entered being between them. The fittings in the saloon are very handsome, being in polished teak and horsehair. All available space is filled with lockers giving good stowage room; a very desirable feature in such a craft. Although the saloon is situated far aft it is not pinched for room at all, the special construction of the vessel obviating any difficulty in this respect. It may be here noticed that the vessel is lit throughout by electricity. There are altogether 23 incandescent lights, the current being obtained from a dynamo placed in the torpedo compartment. The same dynamo is used for the search light when required. In the conning tower, through which the saloon is entered, there is a duplicate steering wheel.

The engine-room compartment is 18 ft. long. The engines are of the ordinary two-cylinder compound surface-condensing type made by this firm, and give a collective power, at full speed, of about 1,550 I.H.P. The air pumps are placed abaft the engines, and are worked by a rocking shaft. The condensers are also placed aft of the engines (Fig. 6). This arrangement gives a roomy engine space; a very satisfactory feature. The engineers' cabins are abaft the engine-room as shown.

Passing to the boiler compartment, which is the main division of the vessel, being 33 ft. long, we come to what may not inaptly be considered the interesting feature in the whole design.

The boiler adopted in this boat is of what may be called the "pipe type," all the generation of steam being carried on in small diameter pipes which are formed of weldless steel tube (Fig. 7). A more particular account of its construction follows hereafter. In front of the boiler space is the forward conning tower, in which a steering wheel is placed. In bad weather or in action the vessel would be steered from inside this, or the after conning tower, but for ordinary service a neat arrangement has been devised. By reference to Fig. 3 it will be seen that there is a small oblique wheel mounted on a diagonal shaft. The latter has a worm on the end which engages with the steering gear. This supplemental wheel and shaft are easily unshipped when not required.

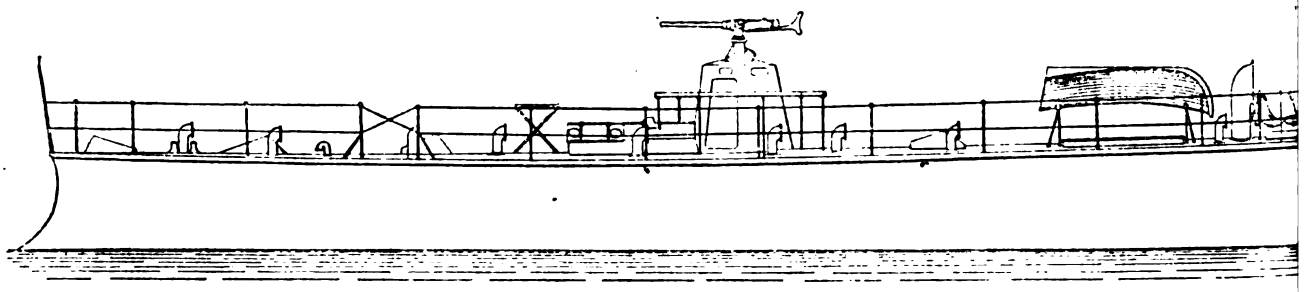
Immediately forward of the boilers is the galley, in

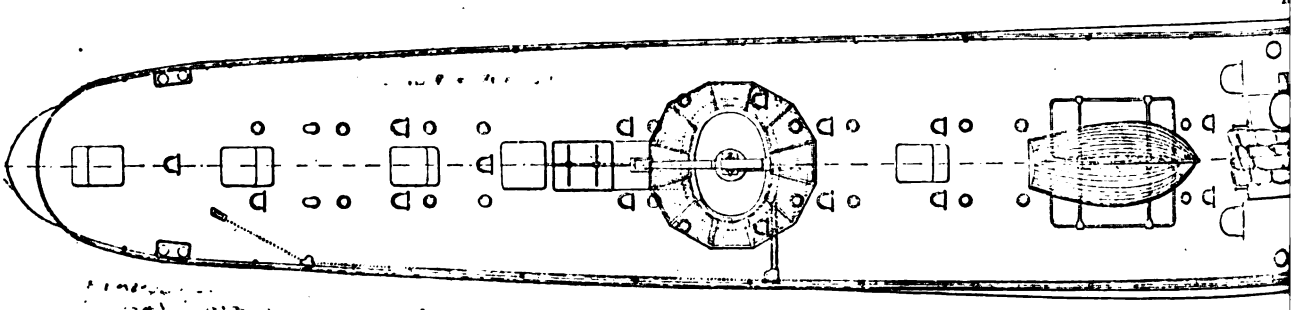
which is placed a Normandy condenser, and next comes the fighting part of the ship. This consists of the torpedo compartment, in which also the crew are berthed. It is 31 ft. 6 in. long, and is divided by a half bulkhead. The two torpedo tubes are built into the boat forward, and the torpedoes are to be ejected by gunpowder impulse. Four torpedoes, 14 ft. 6 in. long by 14 in. in diameter, will be carried, two in the tubes and two stowed below, as shown in Fig. 3. There is only bow discharge. The gun armament is, however, an important feature, there being four 1·85 in. Hotchkiss guns, two on the conning towers, and two broadside, as shown in Fig. 2.

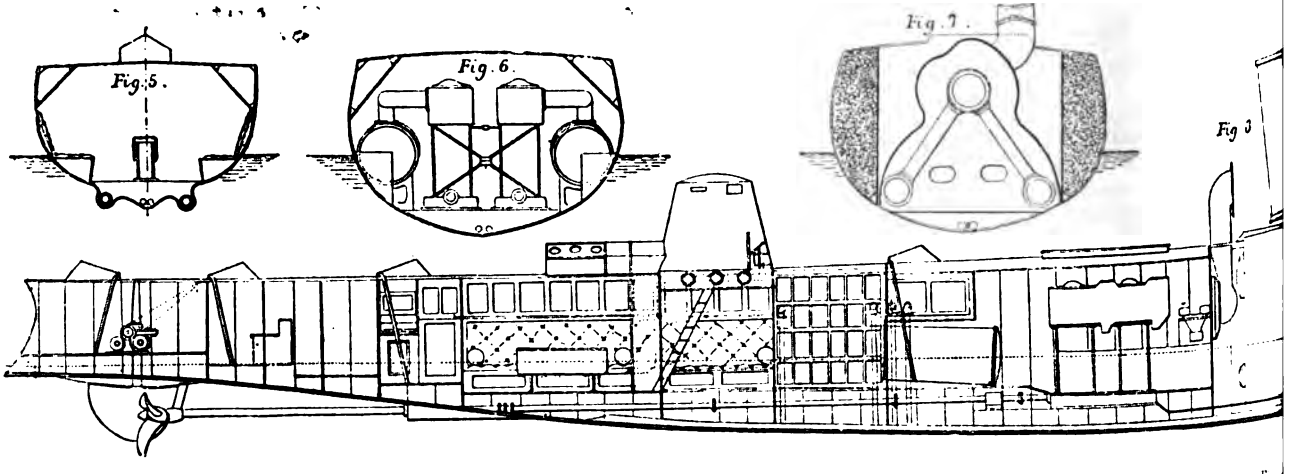
Amongst other features it may be noticed that the funnels are placed diagonally across the boat, and are of oval section. The electric light projector is mounted on a slide running on a bridge that stretches across the vessel amidships. A Baxter's dwarf capstan is placed forward. Turning now to the boilers of the *Coureur*, these, as will be seen by reference to our double-page illustration, are two in number, placed front to front, so that the stoking place is between them, thus giving ample room. Each boiler consists essentially of a horizontal drum or separator at the top, a large number of generating tubes, two horizontal cylinders placed in the wings of the furnace, from which the generating tubes spring, and two connecting pipes between the separator and wing cylinders. So long as there is any fire in the grate the water is constantly circulating through these parts, rising in the generating tubes and falling in the down-comer connecting tubes.

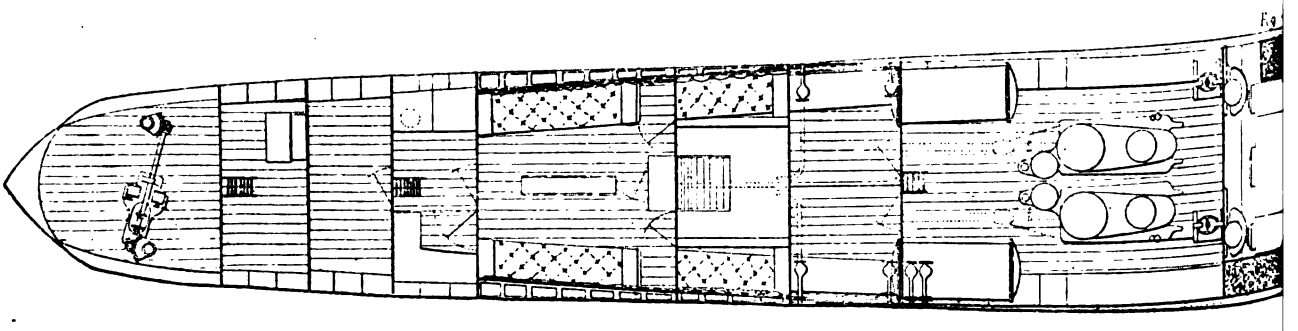
Referring to our illustrations of the boilers, Fig. 1 is a front elevation of the boiler in the boat, Fig. 2 is a longitudinal sectional elevation, Fig. 3 is an elevation with the front removed, and Fig. 4 is a transverse section on the line A B. The feed water is first pumped into the separator or steam collector. This is the horizontal cylindrical vessel near the top of the boiler. From this lead the two down-comers, through which flows any water in the separator in the two wing cylinders placed at the sides of the grate. By reference to our illustrations of the vessel, it will be seen that the separator and wing cylinders project at the front through the casing, and that the "down-comers" are straight pipes placed at the front of the boiler to the stokehole space, being of course clothed to prevent excessive radiation. In the boiler we now illustrate, however, the "down-comers" are curved pipes (see Fig. 2) contained within an extension of the casing at the back of the boiler, a difference merely of arrangement, which does not affect the principle. The normal level of the water is about halfway up the separator, although considerable latitude may safely be allowed in this respect. From the wing cylinders the water rises in the generating tubes to the separator, a greater or less proportion, according to the extent of the fire and volume of feed, becoming, in its passage, converted into steam. In order that the separator may properly perform its functions, it is necessary that it should not be subject to the heat of the furnace, and this fact governs, more or less, the shape of the generating tubes. Figs. 3 and 4 show their course in passing from the wing cylinders to the separator. The greater number are arranged as shown in continuous full lines in Fig. 4, those in full lines in Fig 3, and in partially dotted lines in Fig. 4, being only the two groups placed at each end, and which are bent differently to the rest for the purpose of protecting the ends of the casing. It will thus be seen that the generating tubes spring from the wing cylinders. From thence they curve inwards over the furnace until the inner row of tubes of each side touch each other. The tubes then bend back again and are curved round so that they ultimately enter the separator at the upper part. As all the tubes of the two inner rows touch each other, it will be evident that they form a continuous arch over the furnace, and the separator being above this, it naturally is shielded from the direct radiant heat of the fire. To more effectually protect the separator, it has on its underside an asbestos baffle.

Having indicated the course of the water as it circulates in the boiler, we will now describe the course of the furnace gases and products of combustion, and to do this it is necessary to go more fully into the arrangement of the generating tubes. As may be seen by Fig. 2, the axis of each lies, when viewed in longitudinal section, in a vertical plane; that is to say, the pipes are only curved in cross-section. The generating tubes have to form a flue through which the products of combustion are conveyed to the chimney. There are eight rows of holes drilled in each wing cylinder, and eight corresponding rows in each side of the separator. As the tubes of weldless steel are expanded into the wing cylinders and separator, it is evident that the holes into which the tubes are expanded cannot be touching each other; but it is necessary that the outer rows of tubes should touch so as to form an approximately smoke-tight flue, the gases of course ascending in the space between these walls. To secure this, the holes are spaced in each row their own diameter apart, any two rows thus forming a zigzag. The tubes of the two outer rows of each cylinder are bent a few inches above the spot from whence they spring, so that they travel side by side, each one touching its neighbour, until they reach within a few inches from the separator, where they have to be bent apart again in order to enter the zigzag row of holes provided for them in the separator. This accounts for four of the eight rows of holes in both wing cylinder and separator. The other four rows have tubes expanded into them, but these tubes are not bent so as to be brought into contact, but follow the course of the flue, the gases playing freely all round them. It will be evident that the number of these internal tubes is only limited by the possibility of their accommodation in entering the cylinders. They might be left out entirely without affecting the principle of the boiler, but in such a case the heating surface would naturally be very much curtailed. The tubes of the outer rows, which form the walls of the flue, not touching each other until within a few inches of the wing cylinders, there must of course be a triangular space left between each pair of adjacent tubes, and it is through these spaces that the gases pass into the tube-formed flue. The gases having ascended through the flue, pass out through the corresponding spaces where the tubes enter the separator, and from thence to the chimney. Such spaces as are not required for the passage of gases are stopped by fireclay or asbestos, and the outer casing, which forms a smoke jacket for the whole boiler, is protected by sheet asbestos, &c. The eight tubes at each end of the boiler are curved in such a manner as to shut in the front and back of the furnace, but the space that they cannot be made to cover is built up with firebrick. The wing cylinders are protected from the direct heat of the



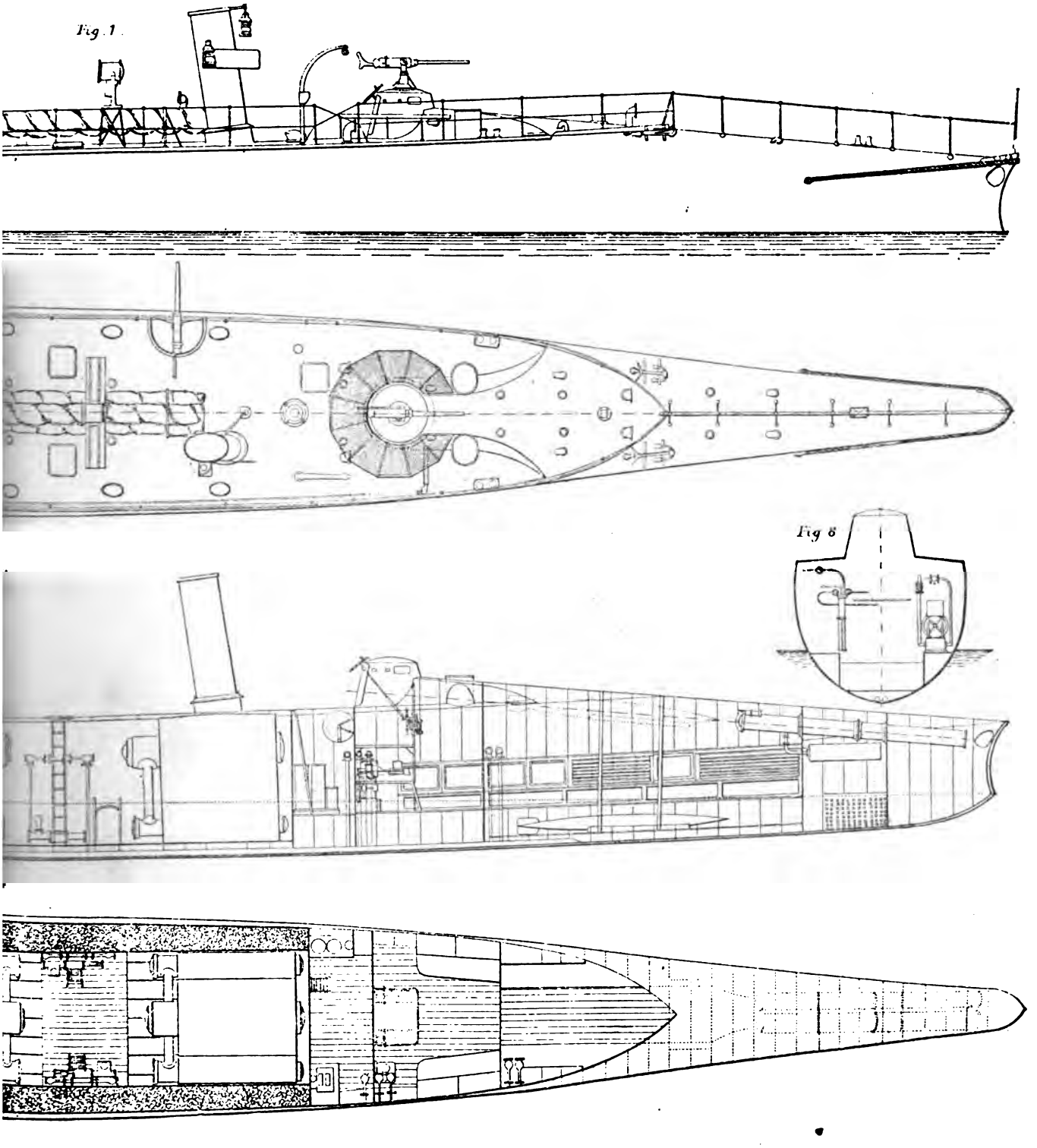






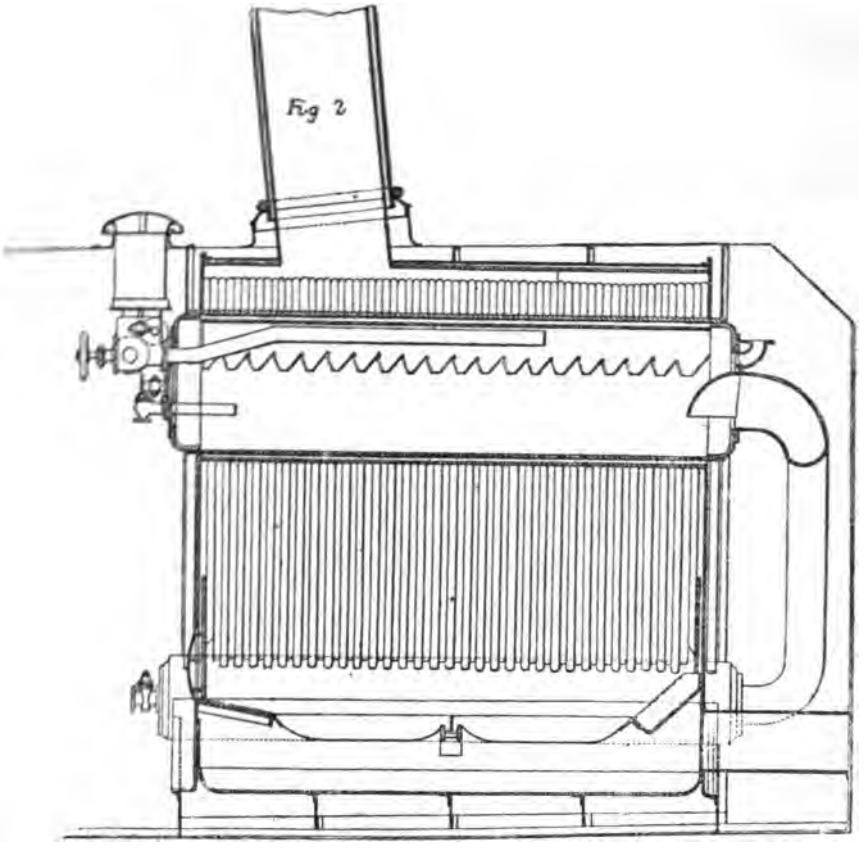
THE FRENCH TORP

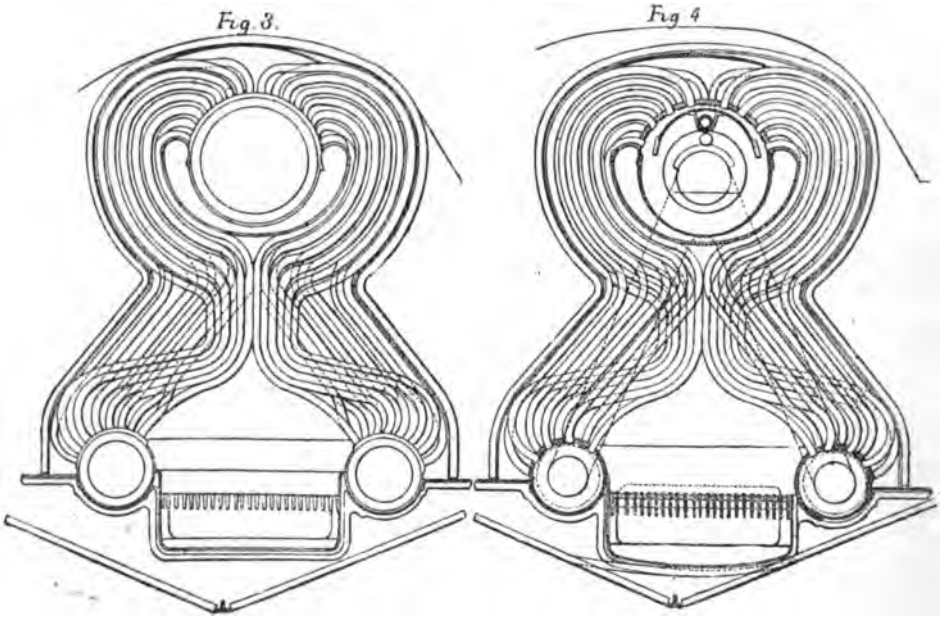
(*Constructed by Messrs. John*



BOAT "COUREUR."

oft & Co., Engineers, Chiswick.)





BOILER OF THE TORPEDO BOAT *COUREUR.*

furnace by dwarf firebrick walls which form the side boundaries of the grate.

The dryness of the steam delivered to the engines is a feature that requires consideration with boilers of this class, and in order to secure this end special provision is made. In Fig. 2 may be seen a serrated plate placed inside the separator. This is bent to a half circle, and lies just within the separator as shown in Fig. 4. Into the semi-annular space thus formed between the separator and this baffle plate the generating tubes discharge their steam and water. The object of forming the edge of the baffle plate in the way shown is that the steam and water may be more effectually separated from each other. Fig. 5 shows the manner in which the notches are formed. A triangular piece is first taken out, and the cut is continued as shown by the line. The edges of the notches are then bent so as to project at right angles to the rest of the plate. The lines at which they are bent are shown in Fig. 5 by the dotted line. Figs. 6 and 7 are side and transverse views of the edge of the plate. This particular form of baffle plate is the result of a large number of experiments, and is found in practice to answer the purpose of separating the water from the steam very effectually. The water that is projected on to the plate rushes towards the notched edge until it meets the upturned part standing out to obstruct or deflect its course. It is then guided down to the lowest part or points of the serrations, and falls to the bottom of the separator. On the other hand, the steam having less momentum than the water, is more easily deflected from its course, and passes round the small spaces at the top of the notches where there is no projecting guide plate, making the best of its way to the internal steam pipe which is placed immediately beneath the baffle plate, as shown in Figs. 2 and 4, and which is provided with saw cuts in the usual way. The boilers of the *Coureur* are constructed to work up to 200 lbs. on the square inch, and we understand that owing to the immunity enjoyed by this type of boiler from leaking and priming, Messrs. Thornycroft & Co. are now fitting them in all torpedo boats built by them.

Fig. 5.

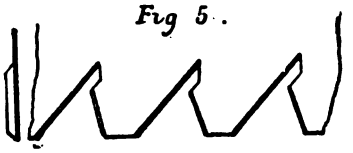


Fig. 6

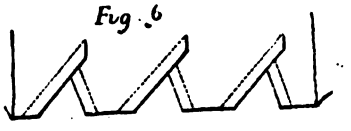
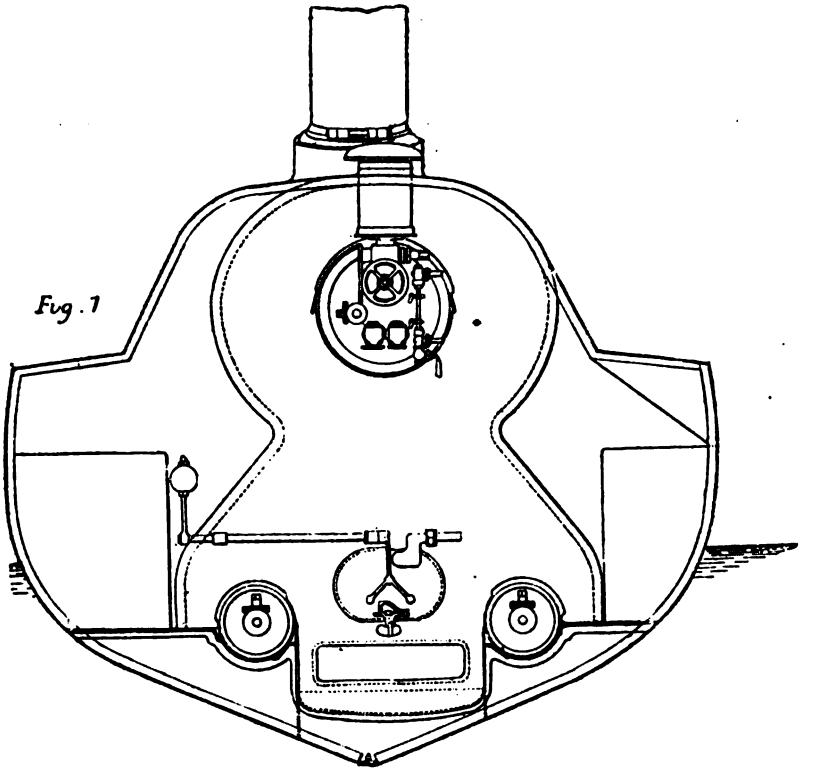


Fig. 7

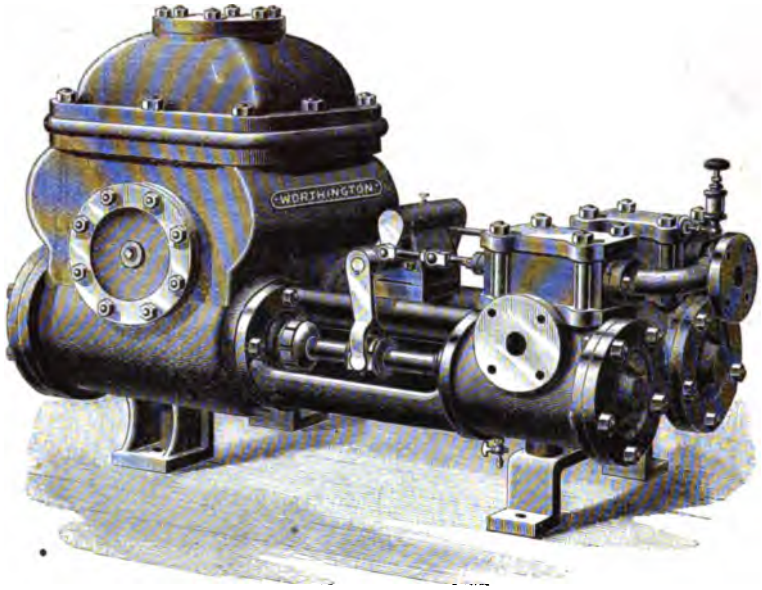


EXHIBITS OF THE WORTHINGTON PUMPING ENGINE COMPANY AT THE GLASGOW EXHIBITION.

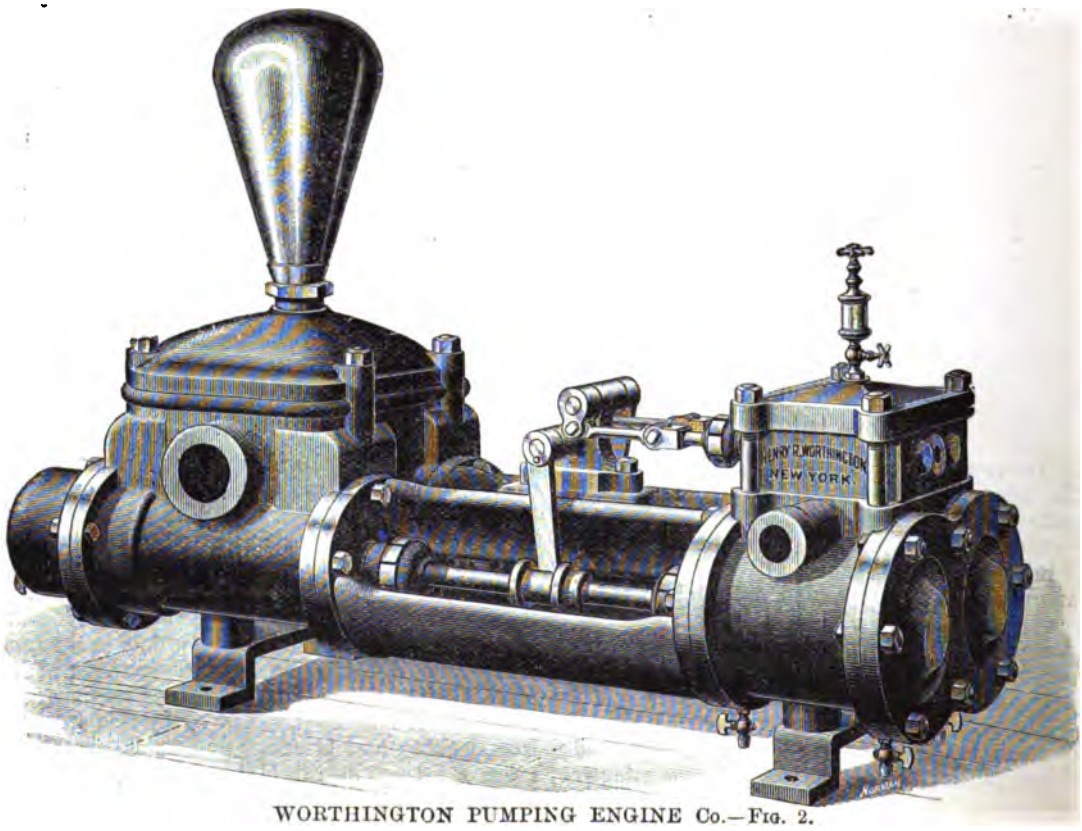
THE Worthington Company have a very fine display of their specialities at the Glasgow Exhibition, and we herewith have pleasure in illustrating a few of their leading types, as designed for marine purposes.

We may mention that the largest example of their work exhibited is a compound engine, the high-pressure cylinders being on the same centre lines with the low-pressure cylinders, or placed "tandem." This engine works very economically, and is more especially designed for waterworks service.

The firm also exhibit their marine ballast pump, designed for a discharge of 100 tons per hour. It is (*vide* Fig. 1) horizontal in design, but light and compact, occupying but small floor space. The firm also make a special type of pump, somewhat similar in general appearance to Fig 1, but specially constructed for bilge and circulating purposes. They also make a very compact



WORTHINGTON PUMPING ENGINE Co.—Fig. 1.



WORTHINGTON PUMPING ENGINE Co.—Fig. 2.

form of combined air and circulating pump, which all marine engineers should see.

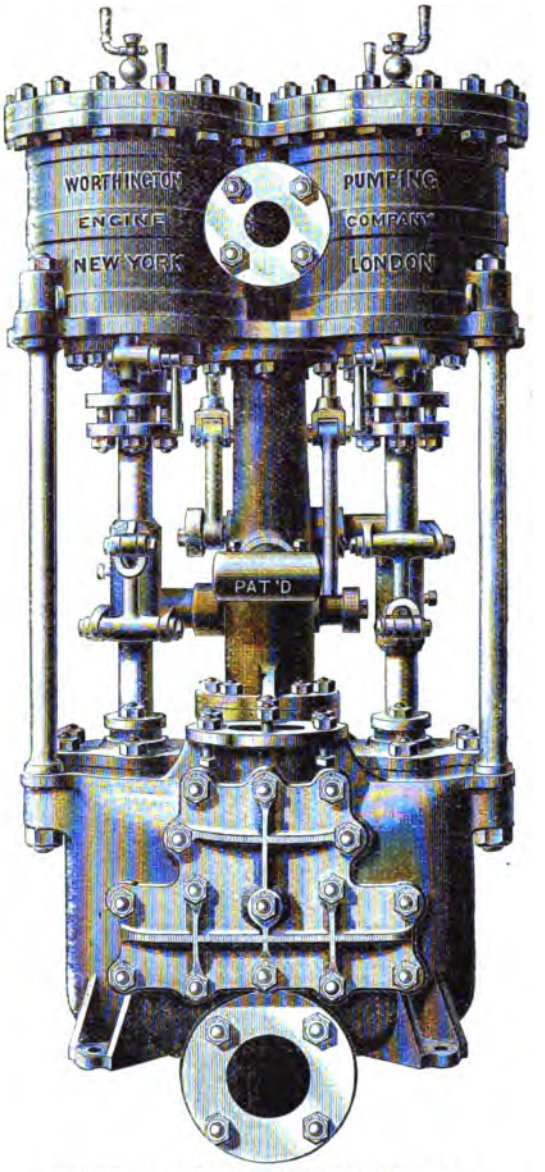
The Company also show a small boiler feed pump, as shown at Fig. 2 of accompanying illustrations, suitable for land or marine boilers, and designed for a working pressure of 160 lbs. per square inch; and immediately adjoining this is a small vertical pump of Admiralty pattern, as shown in Fig. 3. This pattern has been approved by the Admiralty engineers on account of its remarkable lightness, combined with strength, and has been adopted with success for torpedo catchers and other Government vessels.

A larger pump, of exactly similar design, may be seen working under steam, the steam supply being controlled by means of a float in the hot-well or feed-water receiver which opens or closes the steam valve according as the feed supply varies in quantity. In the event of the water level in hot-well falling to such an extent as to uncover the suction to pump the latter is brought to a standstill automatically, and again moves forward as the supply increases.

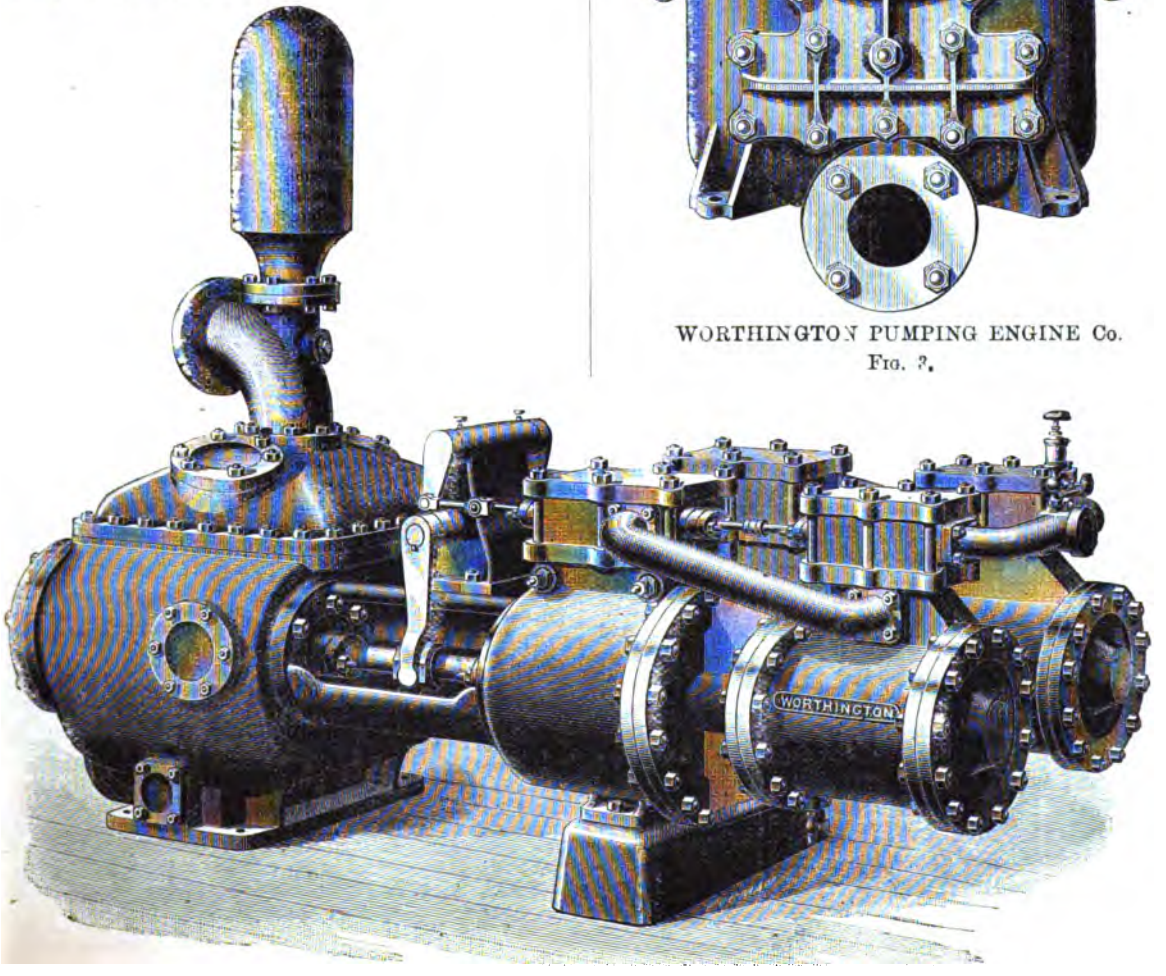
This type have water ends entirely of gun metal. They have been supplied to the new International Inman steamer *City of New York*, the model of which is quite a feature of the Exhibition. All the pumps in the steamer, as well as those in her sister ship, the *City of Paris*, are Worthington pumps.

Fig. 4 is a very good example of the compound type of pump, which we need scarcely say has many advantages over the ordinary high-pressure form.

Taken altogether, the Company's exhibit is a very interesting one, and should be seen by all engineers attending the Exhibition.

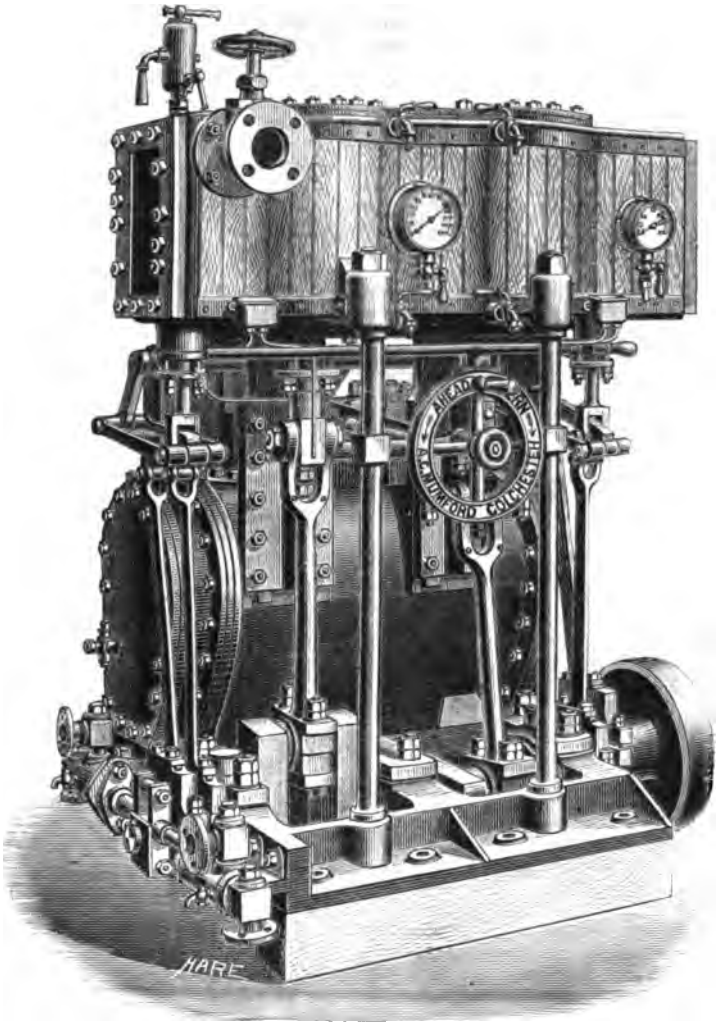


WORTHINGTON PUMPING ENGINE Co.
FIG. 2.



COMPOUND SURFACE CONDENSING ENGINES FOR THE S.S. YACHT "SUNMAID."

THE accompanying illustration shows a very neat and compact set of compound surface-condensing machinery supplied by Mr. A. G. Mumford, of Culver Street Ironworks, Colchester, for Mr. Northall Laurie's new yacht *Sunmaid*, full particulars of which appear under the head of "Launches," and on board which the engines were fitted by Mr. Mumford.



The cylinders are 8½ in. and 15 in. diameter, and have a stroke of 10 in. The engines throughout are very strongly and compactly made, and are a nicely finished "yacht" job, the crank shaft, connecting rods, and valve gear being of steel. The boiler is of the ordinary return tube type, made of steel, and the whole of the machinery has been constructed to Lloyd's requirements for a working pressure of 100 lbs. per square inch.

Mr. Mumford's long experience with this class of machinery is sufficient guarantee that it will be of the best both as regards design and workmanship.

THE GLASGOW INTERNATIONAL EXHIBITION OF INDUSTRY, SCIENCE, AND ART.

(Continued.)

MESSRS. SWAN AND HUNTER, of Newcastle-on-Tyne, have their ideas of a modern mail and passenger steamer embodied in model form, and this is one of the most interesting objects at their stand. They restrict their length to 460 ft., with a breadth of 63 ft., and depth 36 ft. The tonnage is 7,200, and the I.H.P. 18,000. The engines they assign to this vessel to drive her 21 knots at sea are twin-screw triple-compound, with four cylinders, 48, 78, 88, and 88 inches diameter, with a stroke of 72 in. The boilers would be 12 in number, double-ended, having in all 72 furnaces. The remaining models at this stand are of iron and steel screw steamers, built by the firm during the past three years for various owners and a variety of trades.

The work of the famous firm of Robt. Napier & Sons, Govan, is represented by a large number of models of ships and photographs of engines. Among the ships exemplified are the war vessels *Black Prince* (frigate), *Erebus* (floating battery), and *Hector* (ram), built by Robt. Napier between twenty and thirty years ago; and the comparatively new cruisers *Leander* (1883), *Australia* and *Galatea* (1887). The principal merchant vessels shown are the *Mexico*, of 7,250 tons, built for the Compania Mexicana Transatlantica; the *Parisian*, of the Allan Line; the *Damascus*, owned by George Thomson & Co., London; the *Aberdeen*, belonging to the same company, and noteworthy as having been the first large vessel successfully fitted with the now highly-approved triple-expansion type of engine. Side by side with these and other examples of modern mail and passenger steamships, Messrs. Napier exhibit notable steamships of earlier times, such as the *Scotia*, of the Cunard fleet, built in 1861, and the *Vanguard*, built in 1843 for the Dublin & Glasgow Steam Packet Co. Altogether the stand of Messrs. Napier is one of great interest and surprising variety, and goes conclusively to prove the long history and high prestige of the firm as shipbuilders.

Messrs. William Denny Bros., of Dumbarton, exhibit a very varied collection, consisting of five full models and twenty-six half-models, ranging from large cargo and passenger steamers to specially-constructed light draught paddle steamers for river service. Amongst the larger vessels represented is a model of the s.s. *Arawa*, of 5,000 tons, built for the Shaw, Savill, & Albion Co., and employed in their direct steam service between London and New Zealand; the s.s. *Jumna*, a vessel of 5,200 tons gross register, built for the passenger and cargo service of the British India Steam Navigation Co.; and the Peninsular and Oriental Co.'s passenger steamer *Clyde*. The steel paddle steamer *Apollo*, built for the La Platense Flotilla Co. for passenger traffic on the River Plate, and the light draught paddle steamer *Thoorea*h, of the large fleet of the Irrawady Flotilla Co., are examples of a type of steamer of light draught, of which Messrs. Denny have produced quite an enormous fleet. By far the most important exhibit, however—and one of the features of the entire exhibition—is an actual ship's dining saloon, with music room above. It has been prepared, and is exhibited, chiefly with the view of showing the artistic and structural skill of the firm's own employés, the whole of the work having been done within Messrs. Denny's establishment at Dumbarton. The workmanship, whether as regards structural design or architectural and decorative embellishment, is most admirable throughout, and the apartments are rarely but filled by delighted spectators.

On the south wall, immediately adjoining Messrs. Denny's deck house, Messrs. A. Stephen & Sons, Linthouse, exhibit one model for each year's shipbuilding by that firm since 1852. These are selected from a total output of 309 vessels, of a total of over 345,000 tons, and include fully-equipped models of three first-class steamers of recent construction.

The Palmer Shipbuilding and Iron Co. (Limited), Jarrow, in one of the finest collections in this class, exhibit models of the cruisers and despatch vessels which they have lately produced for the British Government, together with several notable passenger steamers, including the *Locksley Hall*, 385 ft. by 45 ft., by 30 ft., of 6,000 tons deadweight, and 11 knots average speed; the *Leamaire*, 260 ft. in length, and of an average speed of 16 knots. At their stand they show, in addition, photographs of ships, views of their works, test pieces and specimens of their iron manufactures; also a working model of triple-compound engines, as fitted in s.s. *Flambourg*, most of which were exhibited at the Newcastle Exhibition, and noticed in our columns at the time.

Messrs. A. & J. Inglis, Partick, content themselves with a

limited display of full models in cases; but all are interesting and representative. One is of the screw steamer *Taroba*, of 5,000 tons, for the East India trade, and one of a smaller class of steamers, representing the *Forth* and *Thames* of the Carron Co.'s new passenger service between Grangemouth and London; while perhaps the most striking is that of the paddle steamer *Ho-nam*, one of those very broad, many-decked, ponderous paddle-wheeled river steamers for China, moulded on the typical American river steamers. Messrs. Inglis have had greater experience in building this type of vessel than perhaps any other firm, and the *Ho-nam* is a very excellent example.

The London and Glasgow Iron Shipbuilding Co. are represented by a number of half-models of steamers and sailing vessels produced during recent years, and two full models, all of them fair examples of the work turned out from Clydeside establishments.

Several of the shipowning lines are themselves the exhibitors of splendid models of crack vessels of their fleets. These we need only name, as the vessels are themselves so well known, and have already been referred to in this article. The Cunard Co. show a beautiful miniature of the famous ships *Umbria* and *Etruria*. The Union Steamship Co. exhibit models of their s.s. *Mexican*, 4,669 tons, 4,600 H.P.; the s.s. *Tartar*, 4,339 tons, 3,700 H.P.; also the *Athenian Moor*, and others of their well-known Cape mail steamers. Messrs. Cayzer, Irvine & Co. are represented by quite a host of their Clan Line steamships, engaged in the direct trade with India. The Allan Line show models of various of their large fleet of North Atlantic steamers, also an exemplar stateroom, showing the kind of accommodation passengers may expect to find on board. The Anchor Line content themselves with showing photos of several of their well-known Atlantic and Mediterranean steamers. Messrs. Geo. Smith & Sons show models of their City Line steamers trading to Calcutta, Bombay, and Rangoon.

Messrs. Joseph L. Thompson & Sons, Sunderland, are represented by several attractive models, one of the steel screw steamer *Euterpe*, built in 1886 for the Austro-Hungarian Lloyd's Steam Navigation Co.; one of the steel steamer *Lancashire Witch*, built in 1887 for the Isle of Man service, attaining a speed of 16 knots; and one of the steel screw steamer *Moyune*, built in 1887 for the China Shippers Mutual Steam Navigation Co.

One of the most interesting exhibits at the stand of Messrs. Lobintz & Co., Renfrew, is a model of the marine dredger *Derotheuse*, built for the Suez Canal Co. It is fitted with Lobintz's patent rock-breaking apparatus, and can remove 400 tons of ordinary soil, or 40 tons of solid rock per hour from a depth of 35 ft. below water.

Messrs. William Simon & Co., also of Renfrew, occupy a large wall space with a numerous collection of models of vessels, principally dredgers and barges, so largely their speciality. A model is shown of the twin-screw barge-loading *Melbourne*, constructed in 1886 for work in Melbourne harbour, and which is the largest and most powerful dredger afloat. The firm also have on view a half-model of the brig of war *Linnet*, built in 1810 for the British Government, and a model of the s.s. *India*, of the Anchor Line fleet (built 1867), the first steam vessel engaged in the North Atlantic trade to be fitted with compound surface-condensing engines.

Messrs. Fleming & Ferguson, of Paisley, a younger firm than Messrs. Simon & Co., are represented at next stand also by models of hopper and other dredgers, one of them so powerful as to be capable of lifting 1,000 tons of spoil per hour from a depth of 40 ft. Messrs. Napier, Shanks, & Bell, of Yoker, make an effective display of the passenger and cargo vessels they have produced, including Clan liners and medium-sized cargo steamers, both screw and paddle, for various owners. Messrs. Robert Duncan & Co., Russell & Co., and D. J. Dunlop & Co., all of Port Glasgow, show attractive displays of the steam and sailing vessels produced by them, none of them, however, calling for any special comment. A similar remark may be made of the collection of models by which Messrs. A. McMillan & Son, Dumbarton, are represented.

Numerous firms exhibiting vessels of the smaller class are worthy of notice; but limit of space prevents our doing so until next number.

(To be continued.)

SHIPBUILDING ON THE CLYDE.—The P. and O. Steamship Company have recently placed an order for four large steamers with Messrs. Caird and Co., Greenock. Each steamer will be 350 feet long, and of 5,000 tons burden.

STEEL EXHIBITS IN THE GLASGOW INTERNATIONAL EXHIBITION.

THE principal steel exhibits are all situated in or near the main avenue in the machinery section, and the first which calls for notice is the magnificent trophy of the Steel Company of Scotland, Limited, Blochairn and Newton Works, Glasgow. This is a rectangular structure of considerable dimensions, entirely formed of beams, rails, angles, &c., elaborately ornamented by an immense number of polished steel bar sections. Round the side and in the interior of this pavilion is ranged a most interesting collection of articles illustrative of the manufacture of open-hearth steel, including rails, tram-rails, angles, bulb-angles, channels, bulb-tees, rounds, squares, flats, and a variety of other sections, steel castings of great weight and intricacy, forgings, and plates flanged by hydraulic machinery. Among the steel castings are shown a two-legged engine column, about six tons in weight, the same in every respect as those made for the new Inman and International steamer *City of New York*, an engine frame of intricate design as supplied to H.M.S. *Pheasant*, several columns, pistons, and cylinder covers as supplied to different vessels of the Navy; and an assortment of propeller blades, and miscellaneous castings—all of which are worthy of careful examination. A collapsed steel boiler furnace flue, taken from the s.s. *County of Durham*, which demonstrates the excellent quality of the steel supplied by the firm, and numerous examples of flanged boiler work, executed by special hydraulic plant, recently erected at the Company's Blochairn Works, will be interesting to boiler-makers. Gun forgings, turned crank shafts, specimens of cast and forged steel projectiles, plates rolled with finished edges in a universal mill, welded pipes, patent sleepers, and a collection of test specimens are also exhibited. We may remind our readers that the Steel Company of Scotland was the first firm to commence the manufacture of mild steel in Scotland, at a time when steel was still regarded with suspicion by the great majority of shipbuilders and owners, and there cannot be the slightest doubt that the operations of the Company have had a highly beneficial effect on the Clyde shipbuilding industry. The Hallside Works were commenced about the year 1871, and some nine years later the Blochairn Iron Works was acquired and converted into a steel works. Up to the present date the firm has turned out about 370,000 tons of steel plates and over 200,000 tons of steel bars and angles, besides rails and other products. The monthly output is now about 12,000 tons, including castings and forgings of the largest dimensions, either in the rough, or turned and finished complete and ready for use.

Messrs. David Colville and Sons, Dalzell Steel and Iron Works, Motherwell, occupy the next stand, and are the second largest steel-makers in Scotland. Messrs. Colville confine themselves almost entirely to the manufacture of plates and bars, and their exhibit suffers to some extent from this circumstance compared with the adjacent displays of brightly turned and painted forgings and castings. In spite of this, however, the numerous collection of test samples, illustrating almost every imaginable method of testing and punishing steel plates and bars, is highly interesting and attracts a large amount of attention. The articles are arranged in tiers, on a massive pyramid of polished wood, surmounted by a boiler shell plate 30 ft. long and 7 ft. wide, and two circular plates, each 10 ft. in diameter. To attempt an enumeration of even a tithe of the articles exhibited would be quite beyond the limits of our space. They prove the high quality of the Dalzell brand of steel, which is already well attested by the reputation which the firm's products enjoy among shipbuilders and engineers. Messrs. Colville were the third firm to start the manufacture of Siemen's steel in Scotland, in the year of 1880. Their works at Motherwell near Glasgow have now a productive power of from 7,000 to 8,000 tons of finished steel per month.

Hadfield's Steel Foundry Company, Sheffield, have a large and admirably arranged display of their well-known steel castings. About 50 tons of castings in all are shown, including apparently examples of everything which it is possible to cast in steel. The most striking part of the exhibit is a group of cast-steel hydraulic cylinders, ranging in length from 6 ft. to 20 ft., placed vertically at the centre of the stand. Some of these cylinders are designed to stand the enormous pressure of 6 tons per square inch, and several of them are turned and polished to prove the absence of any porosity. The great bulk of the castings are intended for mining, colliery, railway, and tramway purposes, only a very moderate assortment of marine requisites being exhibited—a cir-

cumstance somewhat to be regretted, considering the leading industries of Glasgow. A few good examples of propeller blade, crosshead, lever, and crank castings are shown; and for dredgers Hadfield's patent cast-steel buckets, as used by the Admiralty, by dredging contractors at home and abroad, and as fitted in Australia to the largest dredger yet built. Examples of the immense dredger buckets presently in use deepening the Ribble between Preston and the sea, are also shown, together with a number of dredger bucket backs, mouthpieces, tumblers, lips, links, and gearing. Messrs. Hadfield have for several years past devoted themselves largely to the production of projectiles for heavy guns. They have been most successful in this departure, as was convincingly shown at the recent Shoeburyness trials, and several projectiles are displayed which have pierced, with apparently little injury, armour plates supplied by the most eminent firms. The collection of manganese steel specimens shown at the south side of the stand is highly interesting, and gives a good idea of the properties of this remarkable material.

Messrs. Charles Cammell & Company, Limited, Sheffield, have an extensive and striking exhibit, adjacent to that just described. It is mainly made up of large finished forgings and armour plates. Among the former the most noticeable object is a turned and polished core for a 68-ton breech-loading gun. Smaller pieces are grouped in the rear of this, and surmounting all is a gigantic model of the three-throw crank shaft, weighing about 60 tons, supplied for the well-known steamship *Aurania* of the Cunard Line. Several tested armour plates are shown, including two heavy plates of the same thickness—one of them being a solid iron plate, and the other a steel-faced plate. These plates were tested under similar conditions, and the result clearly proved the superiority of the compound armour. The iron plate was completely pierced by the projectile, while the steel-faced plate suffered comparatively little injury. A fac-simile wooden model of the 10½ in. compound plate which successfully withstood the attacks of three forged steel Holtzer, and two Palliser chilled cast-iron projectiles, fired at a range of 10 yards during the trials at Portsmouth in March last, affords further evidence of the superiority of compound armour. The spaces between the larger objects of this exhibit are filled in with a variety of smaller articles, including projectiles, castings for locomotive and marine purposes, cases of tool, steel bars, etc., and assortments of springs of all kinds, all of which, in common with the larger articles, are highly finished.

Messrs. William Beardmore & Company, Parkhead Forge, Glasgow, have a fine display of steel forgings, plates, beams, angles, &c., opposite Messrs. Cammell's exhibit. A hollow steel propeller shaft for the Italian warship *Re Umberto* occupies the front of the stand. It is 37 ft. 2½ in. long, 21½ in. diameter, with a 13½ in. hole through the centre, and weighs about 13 tons—the original weight of the ingot from which it was forged being about 52 tons. At the opposite side is a steel three-throw built crank shaft, 15½ in. diameter, 21 ft. long, and weighing 17 tons. Both of these shafts are supported on 6-ton ingots, intended for rolling into shell plates, for the Spanish cruisers presently building at Barcelona. Other exhibits of interest are a single-throw built steel crank shaft, 14½ in. diameter and 7 ft. long, with a 3 in. diameter hole through centre; a wooden model of a single-throw steel crank shaft, 19½ in. diameter and 9 ft. 6 in. long, with 9½ in. diameter hole through centre, supplied to the Italian ironclad *Re Umberto;* some large boiler plates and cases containing polished sections of the bars rolled by the firm, and a most instructive collection of test specimens. Messrs. Beardmore were the second firm in Scotland to adopt the manufacture of mild steel, and the *first* hollow triple-throw steel crank shaft was made at the Parkhead Forge. The steel making plant now consists of eight furnaces of large size and modern construction, and the monthly output of finished steel, in the form of plates, bars, and forgings, ranges between 3,000 and 3,500 tons.

Messrs. John Spencer & Sons, Newburn Steel Works, Newcastle-upon-Tyne, whose steel manufactures are so favourably known among engineers, have only a small stand. They show several patented specialties, including a Foster's patent crank shaft a Dickinson's patent crank shaft, finished complete, a similar shaft cut through, to show the soundness of metal, and a steel propeller blade, tinned, to prevent corrosion, by Johnston's patent method. A few miscellaneous steel castings, including a locomotive driving wheel centre, 6 ft. 6 in. diameter, and some forgings, all of excellent quality, are also shown. The portion of this exhibit most likely to attract attention is a number of what are called "Newburn's homogeneous iron" castings. This material is described by Messrs. Spencer as a special make of very soft steel, containing only a low percentage of carbon. It is said to be equal in strength to the best wrought iron, and can be readily worked and welded, and, like wrought iron, it will case-harden. Newburn homogeneous iron gives 22 to 25 tons tensile strength, with an elongation of 30 to 40 per cent., and is specially adapted for making castings to replace intricate smithwork.

Messrs. John Brown & Company, Atlas Works, Sheffield, have a very extensive display near the western extremity of the avenue. The principal exhibit is a magnificent Siemen's steel propeller shaft, 19 in. in diameter, with a 42 in. coupling flange, and a 23 in. collar, and a total length of 60 ft. This forging was executed in the powerful hydraulic press recently erected by Messrs. Brown & Co., and specially designed for the production of the heaviest descriptions of steel forgings. This shaft is solid, but it would have been shown bored through had time before the opening of the Exhibition permitted. Near the west end of the stand is a very large marine boiler front plate, with four furnace holes, and four Purve's patent ribbed flues fixed in position. Messrs. Brown & Co. effect the flanging of these large plates by special hydraulic plant at a single heat. A boiler plate, 28 ft. long, 9 ft. wide, and 1⅛ in. thick, said to be the largest boiler plate yet rolled, reared at the back of the stand, and a chemical pan over 9 ft. in diameter and 2 ft. 4 in. deep, pressed from a steel plate by hydraulic power, are sure to attract attention. A number of steel castings of excellent quality are shown, including a stern tube bracket for a twin-screw steamer, and a propeller blade intended for the Inman and International steamship *City of Paris*, now in course of construction at Clydebank by Messrs. James and George Thomson. Armour plates, of course, form a feature of this exhibit, and a group of five plates of different periods is arranged to illustrate the improvements made in armour and projectiles since the days of spherical cast-iron shot.

The remaining steel exhibits are located in Courts 1, 2 and 3, and are on a much smaller scale than those already noticed. Messrs. Cooker Brothers and Messrs. Jowitt & Sons, of Sheffield, show in Court 1 assortments of tool, steel bars, files, springs, etc., and in Court 3 Messrs. Seebohm & Dieckstahl have a handsome and well-arranged stand, with numerous samples illustrating the manufacture of the finest qualities of tool steel.

The West Cumberland Iron and Steel Company, Limited, have a case in Court 2 containing a number of steel articles, but its contents are of interest to railway and civil engineers, rather than to shipbuilders or marine engineers, and the same remark applies to the exhibit of the Ebbw Vale Steel, Iron and Coal Company Limited, in the same court.

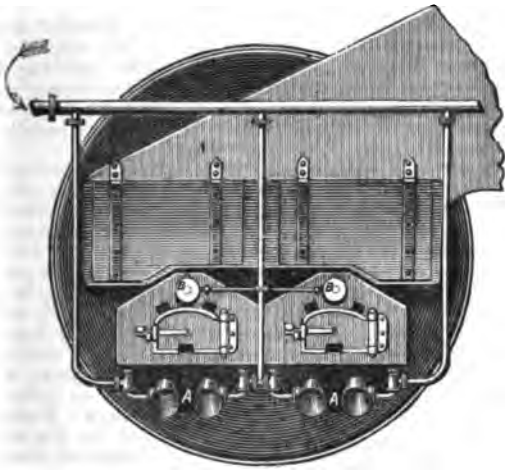
The Coats Iron and Steel Company, Coatbridge, show a number of samples of their Siemen's steel, tested in a variety of ways, proving the reliability of the material. This firm is one of the more recent additions to the list of Scotch steel manufacturers, and their product is principally angles and bars of various sections, the monthly output, in steel, being about 2,000 tons.

The Consett Iron Company, Limited, Blackhill, Durham, have in Court 3 an interesting display of their leading productions, including a number of steel samples of various kinds. This firm has long been known for its iron plates; but the manufacture of steel was only commenced a few years ago, and the rapid substitution of the latter for the former material is made strikingly evident by the fact that the annual make of iron plates at their works has fallen 90,000 tons to 25,000 tons, while the make of steel plates has in a few years risen to about 100,000 tons per annum. The process adopted is the Siemens, and the tested specimens shown bear evidence to the quality of the Company's steel.

The Glasgow Iron Company exhibit in the same court a number of samples of basic steel plates and bars. This stand is of interest as being the only display of basic steel in the present exhibition, the other Scotch basic firm, Messrs. Merry and Cunninghames, who exhibit in Court 2 a large model of their Carnbroe Iron Works, having contented themselves with a very few samples of steel, placed along with specimens of pig and malleable iron. The Glasgow Iron Company have been very successful with the quality of their basic product, and our readers will remember that they were one of the first firms which proved to the satisfaction of Lloyd's and the other public surveying bodies, that reliable steel could be produced by the basic process. An examination of the extensive collection of severely treated steel specimens at their stand will go far to convince the most sceptical that this is the case, and that basic steel makers, though at present handicapped by the abnormally low price of hematite ore, may reasonably look forward to a prosperous future. The Glasgow Iron Company make their steel from cinder pig at their Wishaw works, where they have three blast furnaces, and three 7-ton Pernor converters, with cogging and rolling mills. Plates and light bar sections are rolled at their Motherwell works, and the average monthly output of basic steel is about 35,000 tons.

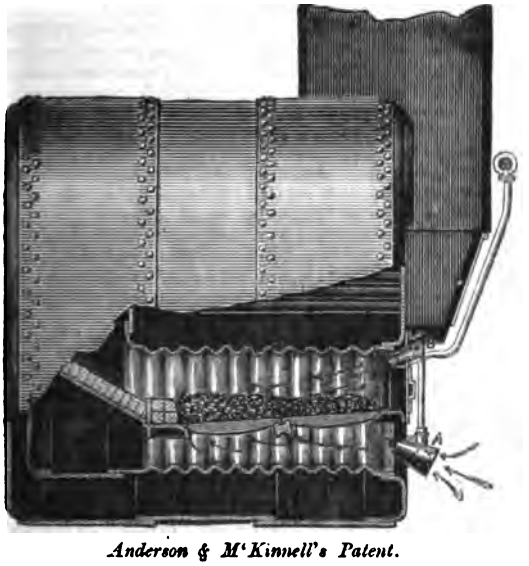
INDUCED DRAUGHT—SYSTEM OF FORCED COMBUSTION.

MESSRS. LEE3, ANDERSON & CO., Clyde-street Anderston, Glasgow, at one of their stands (344) in the machinery section of the Glasgow International Exhibition, have an interesting exhibit of Anderson & McKinnell's patent system of forced combustion for steam boilers and ship ventilation. This may be described as a method of inducing draught by the action of compressed air issuing from patent nozzles, the compressed air being supplied by combined steam engine air compressors. The nozzles, two of which are applied to the ashpits of furnaces of the usual diameters, may be applied to any boiler without any interference with existing arrangements. The nozzles, which are of brass, and adjustable to allow of exact



Anderson & M'Kinnell's Patent.

regulation of the draught, are enclosed in steel cones, A A, which are attached to brass swivel cocks, so that everything can be swung clear when access to the ashpits for cleaning fires, &c., becomes necessary. The swivel cocks close automatically when the apparatus is removed from the ashpits, and so prevent waste. A supplementary nozzle, B, projects into the furnace above the



Anderson & M'Kinnell's Patent.

door, as shown in the illustration, affording a supply of air for the ignition of escaping combustible gases, thus preventing the production of smoke. The nozzles are simple in construction, and as they have no working parts cannot get out of order. This system has been successfully applied to a number of large steamers of the Cunard, Laird, and other well-known lines. It is also applicable to land boilers, and in such cases it may be convenient to place the air compressor at some distance from the boilers, and drive it from any convenient line of shafting. In connection with this system, the firm shows a compound air compressor of improved designs, and a welded malleable iron air reservoir. At the same stand they also exhibit a patent nozzle for heating and circulating water and other fluids.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from June 25th to July 25th, 1888.

Allen, Wm. T., chief engineer to the *Glatton*, to date July 17th.
Boyd, George, fleet engineer, to the rank of inspector of machinery has been cancelled in accordance with his request.
Brown, W. J. C., retired chief engineer, has been advanced to the rank of staff engineer in Her Majesty's Fleet.
Burstow, Hugh, staff engineer to the *Achilles*, to date July 10th.
Calloway, Richd. G., staff engineer to the *Medusa*.
Dewar, Alexr., staff engineer, has been advanced to the rank of fleet engineer in Her Majesty's Fleet.
Hall, Robt., staff engineer to the *Dreadnought*, to date July 23rd.
Harding, W. J., chief engineer, has been advanced to the rank of staff engineer in Her Majesty's Fleet.
Hearson, George Henry, engineer, has been promoted to the rank of chief engineer in Her Majesty's Fleet.
Johnson, John R. D., chief engineer to the *Humber*, to date July 17th.
Lane, Charles, chief engineer to the *Indus*, additional, temporarily.
Little, Edwin, chief engineer, re-appointed to the *Canada*, on promotion.
Miller, Matthew Richard, has been advanced to the rank of staff engineer in Her Majesty's Fleet.
Morgan, John Tolley, has been advanced to the rank of fleet engineer in Her Majesty's Fleet.
Skinner, Wm. H., chief engineer to the *Tyne*, to date July 17th.
Trench, Rich. J., chief engineer to the *Asia*, for the *Thunderer*, to date July 1.
Vincent, Wm., fleet engineer to the *Agamemnon*, to date July 23rd.
Vine, Edwd. R., chief engineer to the *Pembroke*, additional.
Weeks, John Charles, fleet engineer, has been promoted to the rank of inspector of machinery in Her Majesty's Fleet.

ANGIER BROTHERS' STEAM FREIGHT REPORT, JULY 21st, 1888.

FREIGHTS during the past fortnight have further improved in the grain trade from Black Sea, Danube, Azoff, and Baltic, with a good business doing for nearly all positions, but more especially for autumn. Even American rates are better, with more demand. In India and China business the homeward employment continues very poor, but is compensated for by the good outward figures still paid. Coasting rates in China keep pretty good. In cotton charters hardly any transactions have been effected, but as soon as the trade settles down to the new forms of 1888 charter and bill of lading (which will soon be the case if owners adhere to them) a good business will ensue, as the tonnage requirements are large. Taking the carrying trade all round, there are few routes in which the out and home voyages together do not leave a good margin with the new type of steamer, and old boats written down in value are doing fairly well, and at present there is every prospect of a very good autumn trade. Engineers and builders continue well employed for the present, and many have work to employ them all through till next spring. A few more of the steamers building on "spec" have found purchasers, and some fresh orders are given out.

TRIAL TRIP OF STEAM YACHT.—The steam yacht *Skean-Dhu*, built by Messrs. Fleming & Ferguson, Paisley, for Mr. Sholto D. C. Douglas, went down the river on her trial run on July 25th, and over the measured mile made a speed of 10½ knots, being half a knot in excess of speed guaranteed. The engines, which are an improved type of quadruple-expansion made by the builders, worked without a hitch, and gave the greatest satisfaction to owner and party on board.

HOAR & BROWN'S HARDWOOD MARKET REPORT, 24th July, 1888.

TEAK.—The deliveries for the last four weeks have been 1,664 loads, and the stock at present in the docks is 8,976 loads, as against 12,126 loads last year. The market is in a most healthy condition—the stocks are gradually being reduced and are now within reasonable compass. The deliveries have been most satisfactory and are much in excess of last year, a'though prices then were much lower than at present. For the six months this year 8,049 loads were delivered, as against 6,148 loads in 1887 and 5,180 loads in 1886. The London market was most fortunate recently in obtaining a very important contract to supply a large quantity of teak logs to the Continent, which considerably increased the deliveries, and certainly gave a fillip to the market.

MAHOGANY.—The market since our last report has not made any perceptible alteration in price, although a fair demand has continued. Several cargoes and portions of cargoes have changed hands privately, and some of these have again found buyers at a turn-over price, showing that retail purchasers are only waiting their opportunity to secure their requirements while these low prices are ruling. Honduras has not been specially applied for by consumers since its scarceness, but should a contract make its appearance for immediate delivery, the tender price must be unusually high. Cuba has been going off satisfactorily, and large sales have been executed, purchasers seeing the advisability of buying while they can secure the wood at such low figures.

INDUSTRIAL NOTES.

CLYDE AND EAST OF SCOTLAND.

THE improved state of affairs in the Clyde shipbuilding trade, which we noted in last month's notes, has fortunately continued throughout July. The contracts have, on the whole, been well distributed, and there are few shipbuilders, either on the upper or lower reaches, who have not secured some new work. The vessels ordered, and on hand on the 30th of June, numbered 97, with an estimated gross tonnage of 186,000, compared with 58 vessels of 100,000 tons last year. The most substantial contract is that secured by Messrs. Caird & Co., Greenock, after a keen competition, from the Peninsular and Oriental Company. The order is for four cargo steamers of 3,300 tons and 4,500 H.P. for the Company's new service between India and China. They will be 350 feet in length, 42 feet in breadth, and 33 feet deep, and will be fitted by the builders with engines on the triple-expansion principle. The other new work includes three new vessels to be built by the Fairfield Co., two of which are large steamers of 3,500 tons each for the North German Lloyd's, and the third of 1,000 tons for a foreign firm; two cargo-carrying steamers of 3,000 tons each contracted to be built by Messrs. Jones, Reid & Co., Port Glasgow, and engined by Messrs. Rankin & Blackmore, Greenock; a sailing vessel of 1,600 tons, by Messrs. Alex. Stephen & Sons, Linthouse; a steamer of about 700 tons, by Messrs. Robert Napier & Sons, Govan, mentioned in last month's notes; a screw steam yacht of about 200 tons to be constructed by Messrs. Russell & Co., Port Glasgow, and a barge 60 ft. long to be built by the London and Glasgow Shipbuilding Company, for foreign owners. The rumour that Messrs. A. & J. Inglis had secured an order for a large steamer for carrying oil in bulk has been confirmed. The vessel is slightly larger than that secured by Messrs. Dunlop, which we noticed last month.

It is expected that several additional orders will soon be heard of, amongst these being four cruisers for the Admiralty.

It is stated, but not confirmed, that the Royal Mail Steamship Co. have contracted with Clyde builders for a steamer of 6,000 tons and 8,000 H.P., similar to one which Messrs. Napier and Sons are presently building, and which will be launched this month. Shipbuilding material is practically unaltered in price, and the new vessels have been taken at comparatively low rates.

Much improvement has also taken place in the engineering trade and the prospects point to activity throughout the autumn, the numerous contracts received by Clyde builders having caused good orders to be distributed amongst steelmakers, founders, &c.

Amongst the contracts booked for marine engines the most important is that secured by Messrs. Napier & Sons, who have been commissioned by the Spanish Government to build a set of twin-screw triple-expansion engines. Messrs. Hanna, Donald and Wilson, Paisley, have secured an important contract to construct a number of iron bridges, weighing in the aggregate about 3,000 tons, and intended to be used in the railway crossing the rivers in Manilla. The bridges are to be ready for shipment by the end of December. The contract for the large quantity of steel required in the construction of the four new Peninsular and Oriental steamers, building by Messrs. Caird & Co., has been secured partly by the Consett Iron Co., Durham, and the Steel Co. of Scotland, whose offer is said to be the lowest on record. It is stated that the Clyde Steel Works, Glasgow, which were quite recently started, are already making about £1,500 of plates per month.

The recent large orders which have gone to the Port Glasgow and Greenock district will have the effect of making the trade prospects of that district much brighter than they have been for two or three years back. For the next twelve or eighteen months the yards in Greenock will be in full employment. Messrs. Caird and Co. have now in hand over 24,000 tons of shipping, including the two large passenger steamers now well advanced for the P. & O. company. Messrs. Scott & Co. are fully employed, and have no fewer than five vessels in their different graving docks. Messrs. Russell & Co. have at present fifteen vessels in their stocks, five at Greenock and ten at Glasgow, and they are always ready to fill up vacant places with new keels whenever a launch takes place.

Large petroleum oil stores and tanks are about to be erected on the outer embankment of the James Watt Dock. It is calculated that this new industry which is now introduced into Scotland for the first time, will bring over £2,000 a year to the revenues of the Harbour trust. The improvement in the shipbuilding trade has unfortunately not extended to the east coast, though the principal yards are well employed. During the month Messrs. Ramage and Fergusson, Leith, launched the *Ancona* for Messrs. Currie and Co., Leith. They have on the stocks, in a forward state, a sister ship, to be named *Rovena*. There is every prospect of a continuance of plenty of work in this yard. Messrs. John Scott & Co., Kirkcaldy, at the end of last month, received an order from foreign owners for a steel screw passenger steamer. Messrs. W. B. Thompson & Co. (Limited) lately launched the fine steamer *Fulmer* for the Cork Steamship Co., and the vacated stocks will be occupied by a steamer for the Clyde Shipping Company, Glasgow.

The magnificent new Inman Liner *City of New York*, built by Messrs. J. & S. Thomson, underwent trials of her machinery about the middle of the month and left for Liverpool on the 21st ult. A vast amount of interest has centred in the performances of this vessel, and sensational, but unauthorised, reports have been made regarding her speed. It was stated that in the opinion of practical nautical men, who observed the vessel from several points, her speed must at least have been 24 knots per hour. Subsequent and more reliable accounts credit the vessel with having attained 20 knots with only about three-fourths of the power developed of which her sets of engines are capable. Doubtless more exhaustive and crucial terms trials will be made with this magnificent vessel at Liverpool, when once she is in the hands of her owners. Her sister ship the *City of Paris* is expected to be launched towards the end of the month.

It is stated, on good authority, that the amount of business transacted and sales made at the Glasgow Exhibition are much greater than at any of the other great exhibitions. The attendants report that Glasgow is a business exhibition, and buyers appear from the most remote districts. The inquiries are also as encouraging as the actual sales made, and the number of circulars and catalogues asked for are greatly in excess of the quantity taken at the other Exhibitions.

For the first time in its history, the Clyde Trust has drawn a revenue of over £300,000 from dues connected with shipping. The actual figures for the past financial year are £311,463. This is a remarkable degree of progress on the Clyde, and in a great degree it is attributable to the foresight of the management in carrying out improvements which have made the river available for vessels of the highest tonnage.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—The extremely unfavourable weather which was experienced during the first half of the month, had a very depressing effect upon trade generally in this district, but the stoppage to shipbuilding operations was particularly serious, and at some

yards the launching of vessels had to be postponed. The aggregate amount of work in the hands of shipbuilders has been increased by the addition of a few important orders, and though inquiries are just now not very numerous, it is felt that a considerable influx of business must necessarily take place in the near future. This expectation is founded on the fact that rates of freight have risen in almost all trades, and that steamers of all sizes—especially those of modern construction—are now paying fairly satisfactory dividends. There are practically no steamers idle, excepting such as are of an obsolete type, and consequently useless, and this is also very justly regarded as a hopeful sign for the future. The strike of engineers which existed in the Mid-Tyne district a month ago was brought to a close by the employers consenting to advance the wages in August. The advance asked for was 2s. per week, and the employers have agreed to give this amount to those operatives who were already rated at 30s. per week or upwards, but those having less than the wage mentioned, are only to receive an advance of 1s 6d. per week. It is understood that Messrs. Hawthorn, Leslie & Co. have obtained an important order from Brazil for a vessel similar in design and dimensions to a magnificent steamer which the firm built for Brazilian owners some time ago. The type of oil-carrying steamer which Messrs. Armstrong, Mitchell & Co. have made a speciality, appears to have achieved a very remarkable success, if such an inference may be drawn from the fact that there is an increasing demand for them. The firm are now utilising nearly the whole of their resources (which, it is scarcely necessary to say, are exceptionally great) in constructing vessels of this classs, and they have several others to lay down when the dozen or so now in hand are completed. At the other establishments there is very little change to note, most of them continuing to have as much work in progress as they can conveniently deal with. There is a probability, however, that one establishment which is now in operation will be closed very shortly. In the marine engineering shops the pressure of work is rather increased than diminished, owing to the recent stoppage on account of a wages dispute, and the consequent desire on the part of the employers to make up for the time lost, and so prevent delay in the finishing of engines in respect of which prompt delivery was stipulated for in the contracts. In the establishments which are devoted to hydraulic and general engineering, business is brisk, and those shops which make the manufacture of steam winches and other deck accessories a special line, are in every instance kept going actively. Messrs. Clark, Chapman & Parsons are now turning out as much work of this description as they have done in former busy periods, and Messrs. Emerson, Walker, & Thompson Brothers are also equalling their best achievements on past years in the matter of output. Messrs. Carrick & Wardale are receiving numerous orders for their well-known steam feed, bilge and ballast pumps, and their well appointed factory at Redheugh was never busier. The local iron works continue working much more regularly than they have done at any time since 1884, and producers of thin sheets are particularly busy. Prices also are firmer, and in the value of the latter description of product especially there is a strong tendency towards enhancement. The steel works at Consett, Newhaven, Gateshead, and Jarrow remain as busy as ever, and though in every instance the output is unprecedentedly large, it is not fully up to requirements. There is little or no chainmaking being done now on the Tyne, but anchor manufacturers are very busy, the various types of stockless anchors being in great demand. Messrs. George Angus & Co., Limited, leather factors and india rubber manufacturers, are able to keep their extensive works actively going, owing to the orders for their specialities coming from foreign as well as home consumers. Their "Amianthus packing" is becoming especially popular, and the manufacture of this article is now an important feature in the firm's operations.

Wear.—The amount of new tonnage contracted for on the Wear during the month of July was not large, but as all the most important firms were already well supplied with orders, the comparatively small share of business done in the way of new contracts has not had the effect of diminishing the activity in the yards. Messrs. Short Brothers launched on the 14th an exceptionally fine cargo boat, which was built to the order of Mr. James Westall, Sunderland. The engines and boilers were supplied by Mr. John Dickinson, of the Palmer's Hill Works, and it says much for the promptitude with which contracts are carried out at that establishment, that steam was raised and the engines put in motion within a week after the vessel had been put beside the quay. Messrs. Short Brothers have an abundance of work, and to expedite as well as cheapen production they have recently made some important additions to their plant. Among these may be mentioned a powerful hydraulic punching machine by Messrs. David Miller and Co., Glasgow, for punching out the large apertures so frequently occurring in the structural arrangements of cellular-bottomed vessels. The machine, which is the first of the kind introduced on the Wear, is a great aid to economical production, and it is probable that many other firms in the district will ere long see the necessity of supplying themselves with similar powerful accessories. Messrs. Doxford launched on the 21st a vessel named the *Chamois*, which has been built for London owners, and they have three others in various stages of progress on the stocks. Messrs. R. Thompson & Sons are preparing a vessel for launching, and are busily engaged in the construction of other vessels that are yet in early stages. They have a large locally-owned steamer undergoing repairs in the graving dock. Mr. James Laing is preparing to launch a large vessel named the *Ohio* which has been built to the order of Messrs. Pinkney for the American trade. The keel for a passenger steamer of the largest class has just been laid by the same builder, who is also engaged in carrying out extensive alterations in the steamers *Elvaston*, *Vindabalto*, and *Robert Dickinson*. Messrs. J. L. Thompson & Sons launched two vessels towards the end of the month, which make in all nine vessels of an approximate tonnage of 25,000 tons put off the stocks in the first seven months of the year. The firm have now in course of framing a sister ship to the large steamer *Pius IX.*, built by Messrs. Boolds & Sharer a couple of years ago for Spanish owners, and they have five other vessels on the stocks. The Sunderland Shipbuilding Company are preparing to launch a large vessel ordered by a local firm, and they have two others of similar dimensions in progress, besides three or four of a smaller class. This Company have lately adopted Messrs. De Bergue's system of pneumatic rivetting (Allen's patent) for frame and beam work, and have found it both economical and efficient. The engineering firms of Sunderland, have, without solicitation or pressure, given to the various classes of operatives an advance of wages equal in amount to that lately conceded by the Tyne employers. This spontaneous action on their part, shows how desirous they are to maintain friendly and peaceable relations with the workmen, and it is to be hoped that the latter will duly reciprocate the feeling. So far as regards the state of business in the marine shops, there is nothing new to note, all being as briskly employed as could be wished. The proprietors of the Pier Engine Works have been very busy lately with repairs to steamers, engines and boilers, and they have had a very satisfactory demand for their two well-known specialities, namely, the "Atmospheric Governor" and the "Interchangeable Chain." The Bloomfield Engine Works, and also the works belonging to Messrs. Douglas, at Bedford Street and Low Quay, continue in active operation, and the same description applies to the works of Messrs. Lym and Messrs. Welford, Pallion. Messrs. J. L. Thompson and Sons have had lately supplied for their new forge, Pallion, several finely finished machines for boring and plaining work, by Messrs. Scriven & Co., Leeds, and there are few establishments of the kind now to be met with that are better supplied with plant of this modern, handy and effective type. The other forges in the district are all very busily employed, and rivet works are also well engaged. Messrs. Lumsden & Co., chain makers, are pretty regularly employed, but the same cannot be said with reference to the anchor smiths, as many of the steamer's outfits that are ordered are made up with patent anchors which are manufactured elsewhere. The firm are, however, about to enter upon the manufacture of a new type of anchor which has been lately patented, and if this venture turns out successful, their operatives are then pretty certain to be provided with full work. There has been a meeting of gentlemen interested in the proposed conversion of the Castletown ironworks into steel works, and their ultimate re-opening as such, and there now appears to be a fair prospect of the project being carried out.

The Hartlepools.—Some important launches have taken place at this centre during the month, and very considerable activity continues to exist at all the yards. Business at the Central Marine Engine Works continues exceedingly brisk, but at the time of writing, some inconvenience is caused by a dispute with the workmen, which however is not likely to cause any very lengthened stoppage. Messrs. Richardson's Engine Works are also in full activity, and the forge belonging to the same firm is also well employed. The Hartlepool Rope Works are doing a satisfactory trade, and the iron works are kept in steady operation, mainly on orders for plates and bars required in shipbuilding.

The Tees.—The leading shipbuilding yards at Middlesbro' and Stockton are well supplied with orders, and bridge works,

though not uniformly busy, are on the whole, having a fair amount of work in hand. The Perseverance Boiler Works, Stockton (Messrs. Riley Brothers), are doing an exceptionally brisk trade, and inquiries for the different descriptions of boilers manufactured continue to be very numerous. At the steel works the high state of activity noted in previous reports is fully maintained, and the improvement mentioned on former occasions as having taken place in connection with the iron manufacture is, if anything, more fully developed.

THE MERSEY.

LIVERPOOL is becoming more than ever a non-building port. There is absolutely nothing to say since our last issue as to fresh business for our ship-yards. We hear regularly of the launch of some Liverpool-owned boats either at the East coast, or on the Clyde, but rarely, and unfortunately it is growing more so, do we hear of a Liverpool-owned boat being built on the banks of the Mersey. There are more reasons than meet the eye in this unfortunate condition of things. Liverpool bankers are decidely antediluvian. No one whose ideas are of a more modern date is we understand eligible for the post of manager of any Liverpool bank, and thus it happens that whilst the Clyde, the Tyne, are regularly sending out fleets of new tonnage, Liverpool is becoming more and more a mere purchaser, instead of being both producer and purchaser. And the cause of all is that Liverpool Bankers will not facilitate the *Shipbuilder*. They will in some rare instances assist the shipowner, but "hardly ever" will they finance a boat on the stocks for the shipbuilder. Bankers may be indispensable, but they are by no means an unmixed blessing. They have driven from Liverpool the tea trade by their short-sighted policy; the wool trade is also being diverted to London, and now we fear the shipbuilding trade is going to follow suit, and Liverpool will become merely a rendezvous of shipowners and forwarding agents. This is the more distressing because the returns of the Mersey Docks and Harbour Board show steady increases of tonnage (most of which belongs to the port), both inwards and outwards, and one cannot but reflect on the immense advantages that would accrue to the port, if all the tonnage registered in Liverpool had been built on the banks of the river to which Liverpool owes its commercial success.

Messrs. R. W. Leyland & Co. have just purchased the ship *Southgate* and it is said they purpose changing her name to the *Wavertree*.

The only Liverpool-owned vessel, built on the spot, during last month was the *Indrani*. This steamer, as we mentioned in our last issue, was built by Messrs. T. Royden & Son for their own account. She is a steel boat of great dimensions, being no less than 3,582 tons register. The Naval Construction and Armament Company, Limited (late the Barrow Shipbuilding Company, Limited), built the s.s. *Gerda*, a steel steam schooner of 498 tons register, for the Argentine Steam Lighter Company, Limited, of Liverpool. Messrs. Russell & Co., Greenock, have just delivered to Messrs. J. R. de Wolff & Son, Liverpool, the ship *Glenalvor*. This vessel is an addition to the already large fleet of big sailing ships that hail from Liverpool; she is 2,142 tons register, 290 feet long, 42 feet broad and 24 feet deep.

The freight market continues to be most irregular. Freights in one direction are good and in another direction have become more depressed, but still the balance is in the upward, and sooner or later there will be good freight markets all round.

Outward freights to the East have not only maintained their full strength, but have steadily progressed, and at the present moment, higher freights are being paid eastward than have been current for many years. This is no doubt partly occasioned by the abnormally low freights at present ruling homewards, but still the outward and homeward freights will leave a little money now, and they would not do so a year ago. To Bombay 25s. 6d. could possibly be got to-day, but certainly 25s., and this, combined with 15s. homewards, would not only pay expenses, but leave a little over. How long the Bombay homeward market is going to continue in its present lifeless condition it is very hard to say, but there is no doubt some combination is necessary by the "liners" before anything like a fair rate will be paid. The Bombay Market undoubtedly exercises a depressing effect on all the Eastern markets. Calcutta is absolutely lifeless, the Madras Coast is very little better, and all round there is no encouraging feature, and were it not that outward freights continue good the Indian Ocean would soon be deserted.

The Mediterranean freights are good—that is, where no asinine competition between the liners injuriously affects all concerned. From the Adriatic, freights are quite 50 per cent. higher than this time last year. From the Black Sea, freights have improved, and there is a very good prospect of a good Autumn business.

American cotton freights are quite at a standstill, not through any weakness in the market, but because charterers cannot make up their minds to pay rates that will induce shipowners to come in, whilst owners seem to have agreed to wait until their figures are obtainable. If this policy be maintained there is no doubt but that a good cotton season will result. Take business altogether it is encouraging; there is no undue anxiety on the part of shipowners to fix ahead, and we feel sure that a new era of prosperity for shipping has started.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—ENGLISH.

Enterprise.—On June 23rd there was launched from the yard of Messrs. J. L. Thompson & Sons, North Sands, on the Wear, a steamer for the cargo trade. She is built of steel, with all the latest improvements, and is about 3,000 tons deadweight. Like the *Discovery*, to which she is a twin ship, she has been built for a Yorkshire firm. She will be engined by Messrs. Richardson, of Hartlepool, and on being launched was named the *Enterprise*.

Gulf of Corcovado.—On June 25th there was launched from the shipbuilding-yard of Messrs. R. & W. Hawthorn, Leslie & Co. (Limited), Hebburn, a steel screw steamer of the following dimensions:—Length, 320 ft.; breadth, 40 ft.; depth 25 ft. She has long poop, long bridge, and topgallant forecastle, cellular double bottom for water ballast, and is built of Siemens-Martin steel, to class 100 A 1 at Lloyd's, and to pass the Board of Trade for passenger certificate. The poop will be fitted for first-class passengers, with smoke room, ladies' room, &c., above. The bridge will contain the officers and second-class passengers, the crew and firemen being berthed in forecastle. The between-decks have been built exceptionally high for carrying emigrants and troops. The vessel is brig-rigged, with steel masts. This is the first of four vessels building by Messrs. Hawthorn, Leslie & Co. for the Greenock Steamship Company of Greenock, for their Gulf Line of steamers, and is intended for their South American trade. She has been built under the immediate inspection of Mr. Headlam, the superintendent of the owners, and will be fitted with steam steering gear, steam winches, and all the latest improvements. The vessel was christened the *Gulf of Corcovado* by Miss Macdougall, daughter of the managing-director of the Greenock Steamship Company.

Tacunare.—On June 25th there was launched from the shipbuilding-yard of Messrs. Yarrow & Co., Poplar, the twin screw steamer *Tacunare*, 126 ft. in length, with a beam of 18 ft., built to the order of the Amazon Steam Navigation Company. This vessel is for the navigation of the Amazon, in the neighbourhood of Para, and is destined chiefly for passenger traffic. She is now being rapidly fitted out to navigate across the Atlantic.

Teak Yacht.—On June 26th Messrs. Simpson, Strickland & Co., launched from their yard at Sandquay, Dartmouth, a teak-built yacht for the "Council of Administration of the Ottoman Public Debt," for use on the Black Sea. She is 95 ft. long over all by 14 ft. beam, fitted with Kingdon's compound surface-condensing machinery.

Lady Helen.—Newburgh.—On June 27th Mr. J. T. Eltringham launched from his shipyard, at South Shields, two vessels from the same slip. The first was an iron paddle tug steamer, named the *Lady Helen*, owned by the Marquis of Londonderry, and intended for service at Seaham Harbour. Her dimensions are 78 ft. by 17 ft. by 9 ft. 3 in., and she will be fitted with a pair of disconnecting side lever engines of 50 N.H.P., having surface condensers, steel tubular boiler, and all modern improvements. The second vessel was an iron screw tug, named the *Newburgh*, owned by Mr. James Fenwick, of Sydney (N.S.W.), and intended for passenger and towing service there. The dimensions are:—86 ft. by 16 ft. 6 in. by 10 ft., class 100 A at Lloyd's. The decks and fittings are of teak. Steam windlass and other approved appliances are also supplied. The propelling machinery will consist of a pair of compound surface-condensing engines of 50 N.H.P., the cylinders being 17 in. and 34 in. diam., with 22 in. stroke. Steam will be supplied from a steel boiler,

worked at 100 lbs. pressure. Both vessels have been built to the order of Messrs. J. P. Renoldson & Sons, South Shields, who will supply the machinery.

Oevelgönne.—On July 5th there was launched from the Low Walker Shipbuilding-yard of Armstrong, Mitchell & Co., a steel screw steamer for carrying petroleum in bulk, named the *Oevelgönne*. The vessel has a carrying capacity of 3,800 tons, and is intended to trade principally between the United States and Hamburg. She is divided throughout into a number of cells or compartments, with arrangements so that they are kept always full. The vessel will be fitted with two powerful Worthington pumps and a complete installation of piping, whereby oil can be pumped in or out of any compartment, or from any one to the other. The ship is built to the highest class Veritas, and will be fitted with the electric light throughout. Immediately after the launch, the *Oevelgönne* proceeded to the works of the Wallsend Slipway and Engineering Company, where she will be fitted with triple-expansion engines of the most improved type, built under the superintendence of Mr. Reinschild, the owner's representative.

Equity.—On July 7th there was launched from the yard of Earle's Shipbuilding & Engineering Company (Limited), Hull, the iron screw steamer *Equity*, built to the order of the Co-operative Wholesale Society (Limited), Manchester, for their special trade between Hamburg and Goole. She is classed 100 A1 at Lloyd's, of the following dimensions:—Length p.p. 220 ft., breadth 32 ft. 2 in., depth of hold 13 ft. 7 in., and has a poop bridge, and topgallant forecastle, accommodation being provided in the former for captain and passengers, while the officers are berthed amidships, and the crew in the forecastle. There is ample water ballast, and approved means for the rapid loading and discharging of cargo. She is schooner-rigged with two pole masts, and has a good spread of fore-and-aft canvas. She will be propelled by a set of triple-expansion, three-crank engines, having cylinders 24 in., 39 in., and 64 in. diameter, by 33 in. stroke.

Rosemorran.—On July 9th there was launched from the shipbuilding-yard of the Palmer Shipbuilding & Iron Co. (Limited), at Jarrow, a screw steamer, built to the order of Messrs. Temperley & Co., of Newcastle. The vessel, which is of steel, will be rigged as a two-masted schooner, to class 100 A1 at Lloyd's, on the three-decked rule. She has two iron decks, laid all fore-and-aft, and the main deck is fitted with grain-trimming hatches. There is a full poop with accommodation for the captain and officers. The engineers will be located in the deckhouse amidships, and the crew and firemen in the topgallant forecastle. A full bridge amidships, extending over the machinery and boiler space, will be made. Water ballast can be carried in the double bottom in the after hold, the engine and boiler space and the cross bunker, and the vessel will have five water-tight iron bulkheads. There is to be a direct steam windlass on the topgallant forecastle, and four steam winches will be placed on board. The steamer is also to have steam steering gear amidships, and Hastie's screw gear aft. She will carry over 4,200 tons deadweight on a moderate draught. The engines, also built by the Palmer Co., will be on the triple-expansion principle—23½, 38, and 62 in., with a 42 in. stroke, and steam will be supplied from two boilers. As she left the ways the vessel was named the *Rosemorran* by Mrs. James Temperley.

Dora.—On July 10th Messrs. R. Irvine & Co., West Hartlepool, launched a steel steamer, 1,140 tons register, and 2,600 tons deadweight, 261 ft. by 36½ ft., by 17 ft. 11 in. She had been constructed on the web principle, with other recent improvements, her engines being built by Blair & Co., Stockton. This order was given by Mr. O. Trechmann, and Miss Mary Irvine named the ship *Dora*.

Swainby.—On July 10th Messrs. W. Gray & Co. launched at West Hartlepool a steel screw steamer of the following dimensions:—Length over all, 310 ft.; breadth, 40 ft. 6 in.; depth, 23 ft. 0½ in., to carry 4,000 tons. Built to the order of Messrs. R. Ropner & Co., West Hartlepool, to class 100 A1 at Lloyd's. She is the nineteenth vessel Messrs. W. Gray & Co. have launched for Messrs. R. Ropner & Co.'s fleet of steamers. The vessel is of the well-decked type with poop aft, containing saloon and cabins for officers, engineers, and a few passengers; long raised quarter-deck, long bridge of extra strength right up to forehatch, topgallant forecastle, with accommodation for crew and petty officers, and having Messrs. Emerson, Walker, & Co.'s steam windlass on top to work patent stockless anchors, slowing into hawse-pipes without the use of the usual crane and cat and fish tackling. The hull is built on the web-frame principle, dispensing with beams, and giving a clear hold for working cargo. Five hatches are fitted, four steam winches, steam steering gear, and two donkey boilers, water ballast under each hold; two iron masts will be fitted, and a full equipment for general trading purposes. The engines, which are on the triple-expansion principle, are being supplied by Messrs. Blair & Co., Stockton-on-Tees. During construction the vessel has been superintended by Captain C. B. Rooke. She was christened *Swainby* by Miss Bains, of Leicester.

Juno.—On July 11th Messrs. Edward Withy & Co. launched from their shipbuilding-yard at West Hartlepool, a steel screw steamer, built to the order of Thomas Robinson, Esq., of West Hartlepool. This vessel is built of Siemens-Martin steel. She is over 300 ft. in length, with a large measurement capacity, and built to the highest class at Lloyd's. The ship has a long raised quarter-deck, short poop, long bridge house and topgallant forecastle. The holds are fitted with iron grain-divisions and cargo battens. All decks, deck erections, skylights, bulwarks, rails, bulkheads, &c., are built of steel and iron. In the main and after holds she is built on the web-frame system, and as there is no obstruction in the hold she will be able to carry cargoes of the bulkiest description. The vessel has a cellular bottom all fore and aft (Withy & Sivewright's patent), and the after peak will also be available for water ballast. Nearly all the shell plates are in 24 ft. lengths, making the structure of the ship very strong. The ship will be fitted with four steam winches, two donkey boilers, steam steering gear amidships, gear aft, and direct steam windlass on forecastle. The ship will be rigged as a two-masted fore-and-aft schooner, with iron pole masts. She will be fitted with triple-expansion engines by Messrs. T. Richardson & Sons, of Hartlepool. On leaving the ways the vessel was christened *Juno* by Miss Bertie Robinson.

Nigretia.—On July 11th Messrs. Raylton, Dixon & Co. launched from their yard at Middlesbrough a steel steamer, built to the order of Messrs. Elder, Dempster & Co., Liverpool. The vessel, which is built on the well-deck type, is of the following dimensions:—Length over all, 304 ft. 3 in.; breadth, 38 ft.; depth (moulded), 22 ft. 10 in., with a carrying capacity of about 3,600 tons deadweight. She has a short hood over steering-gear aft, water ballast, long bridge extending to foremast, and is fitted throughout as a first-class cargo steamer. She carries Emerson-Walker's direct-acting horizontal windlass. She will be fitted with engines by Messrs. T. Richardson & Sons, of Hartlepool, on the triple-expansion principle, of 200 N.H.P., having cylinders 22 in., 35 in., and 59 in., by 39 in. stroke. On leaving the ways she was christened the *Nigretia*.

Framnes.—On July 11th there was launched from the yard of Messrs. Wood, Skinner & Co., Bill Quay, a steel screw steamer, built to the order of Messrs. Fearnley & Eger, of Christiania. The principal dimensions are:—Length, 262 ft. 9 in.; breadth, 35 ft. (moulded); depth 19 ft. 2 in.; with a dead-weight carrying capacity of 2,250 tons. She is constructed on the cellular bottom principle, and as well as taking the highest class at Lloyd's, will also take the highest class in the Norwegian Veritas, 1A1, having been built under the special inspection of Mr. Lauritz M. Bodin, of London, principal surveyor to the Norwegian Veritas. The vessel, during her construction, has also been superintended by the inspector of the owners, Captain L. B. Foss. The engines have been built to Lloyd's and Norwegian Veritas requirements by the North-Eastern Marine Engineering Co. (Limited), Wallsend. They are on the triple-expansion system, having cylinders 18½ in., 30 in., and 49 in. by 33 in. stroke, and are capable of indicating 750 H.P. The vessel, which was named the *Framnes*, has been specially adapted for the Black Sea and Baltic trades, and is fitted with all modern appliances for efficient and economical working. The christening ceremony was performed by Mrs. Wood.

Hurworth.—On July 11th Messrs. W. Gray & Co. launched at West Hartlepool, the twentieth steamer they have built for Messrs. R. Ropner & Co. This latest addition is 300 ft. long, 38 ft. broad, and 22 ft. 2 in. deep, and will carry about 3,500 tons deadweight. She was christened *Hurworth* by Miss Kitty Baines, of West Hartlepool. The *Hurworth* has a poop, long raised quarter-deck, long bridge of extra strong construction, topgallant forecastle, leaving only a short well-deck, and is fitted with patent windlass, by Emerson, Walker & Co. She is similar in her general arrangements to the screw steamer *Swainby*, launched the day previous. She will also take Lloyd's highest class. The arrangements and building have been under the superintendence of Captain C. B. Rooke. Triple-expansion

engines are being supplied by Messrs. Blair & Co., Stockton-on-Tees.

Gerent.—On July 14th Messrs. Short Bros. launched from their yard at Pallion a handsomely-modelled screw steamer, built to the order of Mr. James Westoll, Sunderland, and of the following dimensions:—Length, 290 ft.; breadth, 39 ft.; depth, moulded, 24 ft. 4 in. The vessel is of Siemens-Martin steel, and is constructed to the highest class in Lloyd's Registry, with cellular double bottom throughout, the holds being subdivided by six watertight bulkheads, with a large hatchway to each hold, and powerful steam winch at each. She has a patent windlass by Emerson, Walker & Co. The accommodation for the captain and officers is fitted with lincrusta panels, and is in a short half-poop, the accommodation for engineers being across the after end of the long bridge house amidships, which covers the engine and boiler and poop, and having high casings on the bridge deck. The crew are berthed in the topgallant forecastle. The vessel is also constructed with a handsome cutwater, which gives her a very graceful appearance. On leaving the ways the vessel was named *Gerent*, the ceremony of naming being performed by Miss Macnair, granddaughter of the owner. The vessel was towed to the quay of Mr. John Dickinson, by whom she will be fitted with triple-expansion engines of 180 N.H.P., having two steel boilers with a working pressure of 150 lbs.

Steam Yacht.—On July 16th there was launched by the Ailsa Shipbuilding Company, Troon, a steel screw steam yacht, built to the highest class at Lloyd's (Yacht Registry). Dimensions—Length over all, 87 feet; length between perpendiculars, 80 ft. 4 in.; breadth (moulded), 14 ft. 3 in.; depth (moulded) 10 ft.; tonnage 71 84-94. She is rigged as a fore-and-aft schooner, and fitted with steam windlass, improved steering gear amidships, and all the latest improvements for a first-class yacht, and finished in a high-class style. The cabins, which are aft, being all in polished real woods—the crew being berthed forward in a commodious forecastle. Engines (amidships) are of the newest triple-expansion type, by Messrs. Muir & Houston of Glasgow; cylinders, 8 in., 13 in., and 21 in., by 15 in. stroke; boiler to supply steam at a working pressure of 160 lb. per square inch, and a high rate of speed is expected. She has been built to the design of Mr. G. L. Watson for Mr. John Baird of Knoidart.

Fulmar.—On July 19th a new steamer named the *Fulmar*, was launched from the Caledon Shipbuilding Yard—Messrs. W. B. Thompson & Co. (Limited)—for the Cork Steamship Company, (Limited). The *Fulmar*, which is a duplicate of the s.s. *Ibis*, also recently built by same firm for the same company, is of the following dimensions:—Length, 250 ft.; breadth, 32 ft.; depth, 15 ft. 8 in., the gross tonnage being 100 tons. The machinery, which has been constructed at the Tay Foundry, consists of triple-expansion engines, with cylinders 21 in., 34 in., and 51 in. respectively, having a piston stroke of 42 in. The vessel, which has been built in excess of the requirements of Lloyd's for the 100 A 1 Class, and which is mainly intended for the Company's Liverpool and Continental trade, will be supplied with steam from two boilers at a pressure of 160 lbs. to the square inch. The vessel was christened by Mrs. William Hunter, of New York, and the owners were represented at the launch by Mr. F. C. Kelsop, the Company's superintendent-engineer.

S.S. Trawler.—On July 21st Messrs. Earle's shipbuilding and Engineering Company, Limited, launched from their yard at Hull, a fine screw trawler which they have built to the order of Henry Smethurst, jun., Esq., of Grimsby, for the purpose of North Sea fishing. In most respects she resembles the more recent additions to the Grimsby fleets constructed by Messrs. Earle, the only departures being in minor details. Her dimensions are:—length 107 ft. 3 in., with a 4-in. rake in the stem, extreme breadth 20 ft. and depth of hold 10 ft. 9 in.; and she is built of iron to Lloyd's 100 A class, with special additions to the scantlings as have been found by experience to be desirable. She has a half forecastle forward and raised quarter-deck aft, and an iron casing over the engines and boiler, the accommodation for captain, mate, and engineers being in cabin aft, and that for the crew in the forecastle. The vessel will be dandy rigged, and has a patent windlass, 6 by 10 steam trawling winch of special design made by Earle's Company, trawl ports and rollers on both sides, steering gear on raised platform amidships, and the usual provision of bollards, hawse pipes, pumps, &c. The engines are triple-compound, made by Earle's Company, to work on the three-crank principle, the cylinders being 11½ in., 17 in., and 30 in. diameter by 18 in. stroke and supplied by steam from a large steel boiler, made in accordance with Lloyd's rules for a working pressure of 150 lbs. per square inch.

Chamois.—On July 21st this vessel was successfully launched from the yard of Messrs. W. Doxford & Sons, at Pallion. Both ship and engines have been built to the specifications of Messrs. Flannery, Baggally & Johnson, of London and Liverpool, and to the order of the Shipowners and Merchants' Agency Co., Limited, and sold by them to Messrs. Jackson Brothers & Cory, of London, for the general trades, and is entirely of steel, built to Lloyd's 100 A 1 class. The principal dimensions are:—Length between perpendiculars, 265 ft.; breadth, 37 ft.; depth, 18 ft. 6 in., with cellular bottom fore and aft. The engines are triple expansion, three cranks with all Messrs. Doxford's latest improvements, the cylinders being 21 in., 33 in., and 54 in. diameter, respectively, and the stroke 36 inches, and they are supplied with high pressure steam from exceptionally large boilers. She is fitted with Bow McLachlan's patent steam steering gear, and Hastie's screw gear aft, and 4 winches 7 in. by 10 in. by Messrs. Welford Brothers, of Pallion, with all the most recent improvements for cargo purposes. The cabins are most tastefully constructed in hard wood in the poop aft, and give most comfortable quarters for captain and officers, engineers being berthed in bridge house abaft engine room. The crew and firemen have exceptionally large and comfortable quarters in front of bridge house. The vessel is a duplicate of the s.s. *Bremner*, recently built for Messrs. Cay, Hall & Co., of South Shields. The christening ceremony was most gracefully performed by Mrs. Walter Jackson.

Sunmaid.—Mr. J. A. Puely launched from his yard last month the S.S. yacht *Sunmaid*, built to the order of R. Northall Laurie, Esq., of 24, Cranley Gardens, London. This yacht is of the composite type and specially designed for river and canal work. Length 68 ft., breadth 11 ft., draught, aft, 4 ft. 6 in., forward 3 ft. She has great accommodation consisting of owner's berth, pantry, and saloon at fore end of engine and boiler space, and ladies' cabin at after end; the cabins rising 3½ ft. above the level of main deck and has 7 ft. head room throughout. The machinery is supplied and fixed by Mr. A. G. Mumford, Culver Street Iron Works, Colchester, and consists of a compound surface-condensing engine, cylinders 8½ and 15 in. diameter and 10 in. stroke, a steel return tube boiler, with separate steam donkey pump. The working pressure of the engines is 100 lbs., and the machinery is constructed throughout to Lloyd's rules and furnished with Lloyd's certificate. A steam winch is also fixed for hoisting the anchor. The *Sunmaid* had her preliminary trial in the Colne without a single hitch in the working of the machinery, and proceeded to the Thames, where the final official inspection and trial under steam was made by Lloyd's engineer, the result of which was highly satisfactory. The yacht has now left for Holland.

Labernok.—On July 21st there was launched from the Jarrow yard of Messrs. Palmer's Shipbuilding & Iron Co. (Limited) a two-masted schooner, of the following dimensions:—Length, 275 ft.; breadth, 40 ft.; depth, 23 ft. 3 in. The vessel has been fitted with iron lower masts, steel main and quarter decks, iron bridge and forecastle decks, long raised quarter deck, 4 ft. in height, to after end of machinery space. The captain and officers will be berthed under sunk poop aft, and there will be a long bridge amidships extending over engine and boiler space, with accommodation for engineers at the after end, and crew and firemen at the fore end. The vessel will have open topgallant forecastle, water ballast, cellular bottom all fore and aft, and four water-tight steel bulkheads, with steering gear amidships, and screw gear aft. The vessel will carry 3,400 tons deadweight on a moderate draught, and will be fitted with engines by the Palmer Company. She has been built to the order of Murrel Brothers, Cardiff, and is named the *Labernok*.

Northumbria.—On July 21st there was launched from the North Sands Shipyard of Messrs. Joseph L. Thompson & Sons, a steel screw steamer of 3,050 tons deadweight, built to the order of the International Line Steamship Company (Limited), of Whitby. The vessel is of the highest classification at Lloyd's, and is of the long-raised quarter-deck type, having full poop aft with accommodation for the captain and officers, the engineers being berthed under the bridge deck amidships, and the crew at the fore end of the bridge. Lamp and oil lockers are provided under open topgallant forecastle. The water ballast is fore and aft, on the cellular bottom principle, and the vessel is fitted with six steel divisional bulkheads, has horizontal steam winches, direct steam windlass and midship steam steering gear, and all the modern improvements for quick loading and despatch. The engines will be fitted by Messrs. Blair & Co., of Stockton, and are of 850 H.P., on the triple-expansion system, having three

cranks. The boilers are of the multitubular form, having a working pressure of 160 lb. to the square inch. As the vessel left the stocks, she was named in the usual manner *Northumbria*, by Mrs. H. Bell, of Rye-hill, Newcastle, wife of the vice-chairman to the company.

Trewavas.—On July 23rd there was launched from the shipbuilding yard of Messrs. John Readhead & Co., West Docks, South Shields, a steel screw steamer of the following dimensions: 259 ft. by 36 ft. by 19 ft., classed 100 A1 Lloyd's special survey. The vessel is of the improved well-deck type, having long bridge amidships, poop, raised quarter-deck, top-gallant forecastle and schooner rigged, and is fitted with all the appliances for grain cargoes and general trades. She will be fitted with triple-expansion engines, also being constructed by Messrs. Readhead, of 170 H.P. nominal, and supplied with steam from two steel boilers at a working pressure of 160 lbs. per square inch. The vessel has been built to the order of Messrs. Edward Hain & Son, St. Ives, Cornwall, and was named the *Trewavas* by Miss Grace Hain, daughter of Mr. Edward Hain, jun., J.P. This is the fifteenth screw steamer built by Messrs. Readhead for Messrs. Hain.

Lady Morgan.—On July 23rd a new iron screw steamer was launched from the shipbuilding-yard of Messrs. Elliot & Jeffrey, Bute Docks, Cardiff. The vessel was built to the order of Mr. W. H. Cable, of Bute Docks, and is of the following dimensions: —Length, 75 ft.; beam, 15ft.; and depth of hold, 9 ft.; engined by the same firm on the compound surface-condensing principle, 14½ by 28 in., with 18 in. stroke; boiler of Landore steel, with 90 lb. pressure. Miss Cable christened the vessel *Lady Morgan*.

Rosecliffe.—On July 23rd there was launched from the shipbuilding-yard of Messrs. Craig, Taylor & Co., Stockton-on-Tees, a screw steamer of the following dimensions:—Length, 281 ft. 3 in.; breadth, 40 ft.; depth, 20 ft. 11 in. The vessel has been built with a long-raised quarter-deck bridge extending to and including foremast and forewinch, short well, and topgallant forecastle. She is fitted with web frames in the holds, and has double-bottom for water ballast in holds and in peak for about 600 tons. She will be fitted with four steam winches and steam steering gear by Messrs. Roger & Co., of Stockton, patent steam windlass by Messrs. Emerson, Walker, and Thompson Bros., light houses, screw gear aft, and all modern improvements, so as to admit of rapid loading and discharging. The engines on the triple-expansion, three-crank system are being constructed by Messrs. Westgarth, English & Co., Middlesbrough, and are of the following sizes:—Cylinders, 21 in., 34 in., and 56 in. by 39 in. stroke; two large boilers, 150 lb. pressure. The vessel will be towed to Hartlepool to receive her boilers, the sheerlegs at Middlesbrough, which were broken over 12 months ago, not yet being replaced by the North-Eastern Company. The vessel has been built to the order of Messrs. Douglas H. Morgan & Co., of Newport (Mon.), and was named the *Rosecliffe* by Mrs. Taylor, of Oakwell Hall, Birstall, near Leeds.

Nordkap.—On July 24th there was launched from the yard of Messrs. Raylton, Dixon & Co., Cleveland Dockyard, Middlesbro', a steel screw steamer, which has been built to the order of Messrs. Harloff and Boe, of Bergen. Her dimensions are—Length over all 283 ft. 6 in.; breadth, 37 ft.; depth (moulded), 21 ft. 9 in., and a deadweight carrying capacity of about 3,100 tons with Lloyd's freeboards. She is built on quarter-deck rule cellular double bottom with long bridge to foremast, short well and top-gallant forecastle. Cabins under short poop aft with two spare berths, patent stockless anchors with steam steering gear will be supplied, and her steam winches and appliances for rapid loading and discharging of cargoes will be of the most complete description. Her engines by John Dickinson, Esq., Sunderland, on the triple-expansion system, will have cylinders 20, 33 and 54 by 39 in. stroke. On leaving the ways she was christened the *Nordkap*, by Miss Inga Raylton Dixon, the youngest daughter of the builder. This is the sixteenth steamer built by Raylton, Dixon & Co. for Norwegian owners, and is one of the largest of the type owned in Bergen.

LAUNCHES.—Scotch.

Oroile.—On June 23rd there was launched from the shipbuilding yard of Messrs. John Scott & Co., Kirkcaldy, a steel paddle passenger steamer for the General Steam Navigation Company, London. The vessel was launched with all her machinery on board and steam up. On leaving the ways she was christened the *Oriole*, and after a short run steamed for Burntisland. The *Oriole* is built of mild steel throughout to Board of Trade requirements. She is 235 ft. long, 27½ broad, and 10 ft. 6 in. draught. She is fitted with compound surface-condensing engines 300 N.H.P., and is of 500 tons. The vessel is fitted with special windlass (Emerson, Walker & Co.'s patent) for working wire rope cable.

Alexandra. — On June 23rd Messrs. M'Knight launched from their yard at Ayr a screw tug of about 140 tons gross measurement, named *Alexandra*, for the Alexandra Towing Company (Limited), Liverpool. Her dimensions are—92 ft. b.p.; breadth, 20 ft.; depth, 12 ft. moulded. The vessel has been built of iron under survey to class 100 A1 at Lloyd's. The machinery, which is compound surface-condensing, will be supplied by Messrs. Muir & Houston, Glasgow. Cylinders, 21 in. and 42 in. diameter by 27 in. stroke; steel boiler, 14 in. diameter by 10 ft. long; working pressure, 100 lb.

Ancona.—On June 25th Messrs. Ramage & Ferguson, Leith, launched from their yard a steel screw steamer of 1,230 tons gross, built to the order of Messrs. James Currie & Co., shipowners, Leith, for their Continental trade. The principal dimensions are:—Length, 249 ft.; breadth, 33 ft.; depth, 18 ft. (moulded). The steamer will be fitted by the builders with triple-expansion engines, having cylinders 18, 30, and 48 in. and 36 in. stroke, with a working pressure of 150 lbs. per square inch. As the steamer left the ways she was named the *Ancona* by Miss Crawford, of Leith, daughter of one of the partners of the firm. The *Ancona* was afterwards taken into the Albert dock to be fitted out.

Moray Chief.—On June 25th a three-masted barquantine from the shipbuilding yard of Mr. Kinloch was launched at Kingston. The vessel is 138 ft. long, 26 ft. broad, and 13 ft. deep. Her register is over 300 tons, while her deadweight capacity will be 520 tons. She will class 11 years A 1 at Lloyd's. When being launched the vessel was named the *Moray Chief* by the daughter of the owner. The vessel is intended for the Brazilian and Indian trade.

Traveller.—On June 26th Messrs. Charles Connell & Co. launched from their yard at Scotstoun the steel screw steamer *Traveller* for Messrs. Thomas & James Harrison, Liverpool. Her dimensions are:—330 ft. by 40 ft. by 28 ft., with a gross tonnage of about 3,200 tons. The vessel has been constructed under the superintendence of Mr. R. D. Barratt, and is fitted with Captain Gell's patent davits and boat chocks, Muir & Caldwell's steering gear, Napier's steam windlass, Smith's stockless anchors, and all the most recent appliances for the efficient handling of both ship and cargo. The machinery has been constructed by Messrs. John & James Thomson, Finnieston Engine Works, under the supervision of Mr. Cadman, the company's superintendent engineer, and is of the most improved description. As the vessel left the ways she was named in the customary manner by Miss Thomson, of Glentower.

Lady Gordon.—On June 27th Messrs. Aitken & Mansel launched from their Kelvinhaugh shipyard a steel screw vessel, measuring 180 ft. long by 27 ft. broad by 11 ft. 3 in. depth of hold, and having triple-expansion engines, with cylinders 15 in., 24 in., and 40 in. diameter by 30 in. stroke. This vessel has been constructed for the Ceylon Steamship Company (Limited), London, and has been specially designed for the mail, passenger, and carrying service round the island of Ceylon. The engines will be fitted by Messrs. Hutson & Corbett, of Kelvinhaugh, and the vessel has been constructed under the supervision of Mr. David Pollock, naval architect, Glasgow, acting under instructions of the managing owners, Messrs. Walker Brothers, London. The vessel was named the *Lady Gordon* by Miss Walker, of Glasgow, and will be under the command of Captain Whitley, lately of the Ceylon Government Service.

Icicle.—On June 28th Messrs. Wm. Simons & Co. launched complete from their works at Renfrew a new steel screw yacht of about 70 tons, named the *Icicle*. It is yawl-rigged, and is the property of an Argyleshire gentleman, and is intended for his family to cruise in.

Skeandhu.—On June 28th Messrs. Fleming & Ferguson, shipbuilders, launched from their yard at Mu.ksworth, near Paisley, a 40-ton steel steam yacht, built to the order of Mr. Sholto D. C. Douglas. As she left the ways she was named the *Skeandhu* by Miss Minnie Ferguson, daughter of one of the builders.

Poseidon. — On June 29th Messrs. William Denny and Brothers, Dumbarton, launched a steel-built schooner of 215 tons measurement for the River Plate service. She was named the *Poseidon* by Mrs. P. Denny, junr., Bellfield, Dumbarton.

Kentigern.—On July 7th, at Linthouse, Messrs. Alexander Stephens & Sons launched a steel screw steamer of about 4,000 tons deadweight carrying capacity, and fitted with triple-expansion engines capable of driving her at a speed of 10 knots loaded. The vessel, which is intended for Eastern and general trades, under the command of Captain Donald Campbell, is of class 100 A1 in Lloyd's, with water ballast arrangements and superior equipments in all respects. She was named the *Kentigern* by Miss Ferguson.

Bellucia.—On July 9th Messrs. D. & W. Henderson launched from their yard at Meadowside, Partick, a steer screw-steamer of 2,715 tons gross, for Messrs. Bell Brothers & M'Leland, shipowners, Glasgow. The vessel, which was named the *Bellucia*, is 310 ft. in length, 39·02 in breadth, and 23·85 ft. deep. Although mainly intended for her owners' carrying trade, she is also provided with limited passenger accommodation. The engines of the *Bellucia* are of the triple-expansion type, and her steering and cargo gear is all of the most improved kind.

Steel S. S.—On July 11th Messrs. Hawthorn & Co., engineers, launched from their yard at Junction Bridge, Leith, a steel screw steamer built to the order of the Admiralty. The vessel, which is 150 tons register, is 100 ft. in length, 21 ft. in breadth, and 9 ft. 6 in. in depth. She will be fitted by the builders with compound surface-condensing engines, 54 H.P. having cylinders 17 in. and 34 in., and 22 in. stroke, with a working pressure of 80 lb. The vessel is to be used for carrying coal and stores, and when finished will proceed to Portsmouth.

Islander.—On July 11th Messrs. Napier, Shanks and Bell launched from their shipbuilding yard, at Yoker, a steel twin-screw steamer, built to the order of the Canadian Pacific Navigation Company (Limited). It is a vessel of a special type, and is designed to meet the requirements of its service in the rapid and comfortable conveyance of passengers between Victoria, the principal trading port in British Columbia, and Vancouver, the terminus of the Canadian Pacific Railroad. As the vessel left the ways, it was christened *Islander* by Miss Harvey, a granddaughter of Mr. Robert Dunsmore, Prime Minister of British Columbia, one of the directors of the Canadian Pacific Navigation Company. The *Islander*, immediately after being launched, was towed up to the harbour for the purpose of being fitted with her engines. In the course of a month or so the vessel will set sail under the command of Captain Robertson, late of the Cunard service. The dimensions are:—Length, 240 ft.; breadth, 42 ft.; depth to main deck, 14 ft. 8 in.; gross tonnage, 1,600 tons. The general arrangement embraces ranges of cabins built on the main and the spar decks, American fashion, with a shade or hurricane deck above all, which can be used as a promenade. Not being intended for cargo, the whole of the decks and deck-houses are devoted to passenger accommodation. The deck fittings include steam steering gear forward and hand gear aft, steam windlass and capstan forward, and steam warping capstan aft. The vessel is also fitted with electric light and electric bells throughout.

Abertay.—On July 13th there was launched from the yard of Messrs. Wm. Simons & Co., Renfrew, the steel screw steamer *Abertay*, built to the order of Messrs. A. & A. Y. Mackay, Grangemouth, under the direction of Mr. James Donaldson, consulting engineer, Glasgow. The dimensions are 230 ft. by 23 ft. by 15 ft. 3 in., moulded to main deck. The vessel has been built under Lloyd's special survey to their highest class, and is designed for the Baltic timber and grain trade. It has a deadweight capacity of about 1,200 tons, and has limited passenger accommodation under quarter-deck. The engines are of the triple-expansion type of 750 I.H.P., and the boilers are constructed for a working pressure of 160 lbs. per square inch, and have the latest improvements. The ship is fitted with Alley & Maclellan's patent steering gear, and also powerful steam appliances for loading and discharging cargo quickly. The *Abertay* was launched with her engines, boilers, and other machinery fitted on board, and almost ready to proceed to sea. The engines and boilers were also made by the builders. As she left the ways the naming of the vessel was performed by Mrs. Sinclair, the wife of the newly-elected member of Parliament for the Ayr Burghs.

Jacinth.—On July 13th there was launched from the building yard of Messrs. John Fullarton & Co., Merksworth, Paisley, a handsome iron screw steamer of 500 tons, built to the order of Mr. Wm. Robertson, 88, Great Clyde Street, Glasgow, this being the eighth steamer supplied to the same owner for employment in his general carrying trade. The steamer is fitted with double bottom on the cellular principle, for carrying a large quantity of water ballast, and has all the latest improvements for loading and discharging cargo, steam steering gear and patent windlass. She carries Wastneys-Smith's patent stockless anchors. The engines, which are of the triple-expansion type, will be supplied by Messrs. William King & Co., Dock Engine Works, Glasgow, and will indicate about 800 H.P. On the dog shores being cut away by Miss Louisa Cowan, Strathbungo, the vessel was named the *Jacinth*, by Miss Susan Reston, Airdrie.

Minerva.—On July 14th a new racing yacht, built for America, was launched from Fife's yard, Fairlie. The craft was named *Minerva* as she left the ways by Miss Mary Fife, and is a broad beamy boat, 40 ft. long, L.W.L., with clipper cutwater, prettily modelled side, and long counter. The *Minerva* is a deep boat, and carries her depth far aft, with heavy keel and spars. W. Fife, jun., is the designer. The *Minerva* will be sailed across the Atlantic.

Muloom.—On July 16th there was launched by the Ailsa Shipbuilding Company, Troon, a steel screw steam yacht, built to the highest class at Lloyd's (Yacht Registry). Dimensions:—Length over all, 87 ft.; length between perpendiculars, 80 ft. 4 in.; breadth moulded, 14 ft. 3 in.; depth moulded, 10 ft.; tonnage, 71 84-94. She is rigged as a fore-and-aft schooner, and fitted with steam windlass, improved steering gear amidships, and all the latest improvements for a first-class yacht and finished in a high-class style, the cabins, which are aft, being all in polished real woods. The crew are berthed forward in a commodious forecastle. The engines amidships are of the newest triple-expansion type by Messrs. Muir & Houston, of Glasgow. Cylinders, 8 in., 13 in., and 21 in. by 15 in. stroke. Boiler to supply steam at a working pressure of 160 lb. per square inch, and a high rate of speed is expected. She has been built to the design of Mr. G. L. Watson for Mr. John Baird, of Kinoidcart. On leaving the ways she was named *Muloom* by Miss Jean Baird, daughter of the owner.

Sode-ga-wia-Maru.—On July 20th Messrs. Wm. Simons and Co. launched complete from their yard at Renfrew the patent hopper-dredger *Sode-ga-wia-Maru*, a vessel of 300 tons hopper capacity, and having a bucket ladder adapted to dredge to a depth of 30 ft. below water level. This vessel is a duplicate of the *St. George*, recently supplied to the Admiralty by the same builders, and it will immediately be masted and prepared for the voyage to Japan, where it will be employed in connection with extensive harbour improvements.

Thetis.—On July 23rd there was launched from the shipbuilding yard of Messrs. John Reid & Co., Port Glasgow, a steel spar-decked screw steamer of the following dimensions:—length, 260 ft.; beam, 37 ft.; depth in hold, 23 ft.; having a gross register tonnage of 1,806 tons. This vessel, which is named *Thetis*, is built on the web-frame system, has water ballast all fore and aft. She has been consigned for a large deadweight carrier, and built for Messrs. Aitken & Walker, of Glasgow, for their general cargo trade. Messrs. Muir & Houston, of Glasgow, are fitting the machinery, which is of triple-expansion arrangement.

Sir Francis Drake.—On July 24th the Grangemouth Dockyard Company launched from their shipbuilding yard on the Forth a steel screw cargo steamer of the following dimensions: length b.p., 260 ft. by 36 ft. beam by 19 ft. 6 in. moulded depth, to carry a dead weight of 2,500 tons all told. She is classed 100 A1 at Lloyd's under special survey: has raised quarter-deck, long bridge deck, and topgallant forecastle, water ballast in cellular double bottom fore and aft, and web frames fitted in fore hold. The engines will be triple-expansion by Messrs. Ross & Duncan, Govan. She will have steam steering gear, four steam winches, steam windlass, and all modern appliances for working ship and cargo. This is the largest steamer ever built in Grangemouth. As she left the ways she was named *Sir Francis Drake* by Miss Kate Triplett, Plymouth, daughter of the managing owner.

LAUNCH—IRISH.

Antrim.—On the 21st July the steamship *Antrim*, built to the order of the Antrim Iron Ore Company by Messrs. M'Ilwaine and Lewis, Belfast, was launched. The vessel is 174 feet in length between perpendiculars, and the machinery, which has been constructed by the firm, is very powerful considering the size of the vessel, the engines being triple compound, of 500 H.P., having three steam cylinders, each working on its own crank. The boiler is made entirely of steel for a working pressure of 160 lbs. Three powerful steam winches (Emerson & Walker's

patent), to be worked by hand or steam, have been fitted. There are very large trimming tanks, and the vessel is rigged as a fore-and-aft schooner, with steel masts.

Fort William—On July 24th Messrs. Workman, Clark and Co. launched from their shipyard, Belfast, a large screw steamer for Messrs. Clark & Service, Glasgow. The new vessel, which was christened the *Fort-William* by Mrs. Clark, wife of the owner, is intended for the Glasgow and West Indian trade. She is spar-decked, 100 A 1 at Lloyd's, and is 271 ft. long, 37 ft. broad, and 26 ft. deep.

Palmas.—On July 24th the new steamship *Palmas* was launched from the yard of Messrs. Harland & Wolff, Belfast. This vessel, which has been built to the order of Messrs. Elder, Dempster and Co., Liverpool, is 312 ft. in length, 39 ft. broad, and 28 feet deep. Her gross tonnage is 2,410 tons. She was built specially to meet the requirements of the highest class at Lloyd's, and is intended to trade between Liverpool and the Canary Islands. She will receive her entire outfit at Messrs. Harland & Wolff's works.

LAUNCH.—GERMAN.

Warlburz.—On June 21st the Flensburger Schiffsbau Gesellschaft launched the screw steamer *Warlburz* built by them for the Bremer Hausa. The vessel is 270 ft. by 37 ft. by 24 ft. 11 in., and is built of German steel to class 100 A 1 at British Lloyd's. The engines, triple-expansion, are also built by the Flensburger Schiffsbau Gesellschaft, and on leaving the ways the vessel was christened by Mrs. V. Freeden.

TRIAL TRIPS.

Helene.—On June 16th the new steamer *Helene*, built by the Flensburger Schiffsbau Gesellschaft, for Mr. H. Schultz, of Flensburg, made her trial trip. The vessel, which is built of English steel to class 1st Division Veritas, is of the following dimensions: length 200 ft., beam 30 ft. 6 in., and 15 ft. 7 in. deep. Her triple-expansion engines, of 360 H.P., worked very satisfactory, and maintained, with an extremely low consumption of coal, an average speed of 9·9 knots per hour.

Northgate.—On June 22nd the steamer *Northgate*, a new vessel, 290 ft. by 38 ft. by 21 ft., built by Messrs. Thomas Turnbull and Son, of Whitby, for Messrs. Turnbull, Scott & Co., of London, left the Tees on her trial trip. Her engines are of the triple-expansion type of 175 N.H.P., with cylinders 22, 36, and 59 by 39 stroke, and working at 160 lbs. pressure of steam, built by Messrs. Blair & Co. (Limited), of Stockton-on-Tees. She made a most successful run, everything working without a hitch. She attained a speed of 10 to 11 knots.

Quito.—On the 23rd of June the Pacific Steam Navigation Company's new screw steamer *Quito*, just completed by Messrs. Laird Brothers, made her official trial trip in Liverpool Bay. Starting about 8 a.m. from the builder's fitting out dock, where she had received her machinery, she proceeded under easy steam for several hours, and then for about five hours consecutively at full speed, the engines working at about 90 revolutions, with 155 lb. to 160 lb. steam, and developing upwards of 900 I.H.P., which is 100 in excess of the contract. The speed ascertained by log during several hours was about 12½ knots, and over the measured mile 13 knots. The trial was in all respects entirely satisfactory. The *Quito* is about 225 ft. long over all, with 35 feet beam, and 22½ feet depth to upper deck, and measures about 1,270 tons O.M. She is built of steel, with a complete steel lower deck. She has been designed to carry a large cargo, besides having space on main deck for cattle and deck cargo, and is fitted with triple-expansion engines. There is accommodation in deck houses on the upper deck for 60 first-class passengers, the state rooms forward and dining saloon aft. There is also provision for carrying a large number of steerage passengers. The vessel is lighted throughout with the electric light, and is fitted in every respect as a first-class passenger steamer, and provided with steam steering apparatus and anchor gear, and all modern appliances. On completion of the trial she was docked in the Morpeth Dock.

Oporto.—On June 26th the new steel screw steam-ship *Oporto*, the latest addition to the Leyland line, left the Sandon dock on her official trip. Among those on board were the following gentlemen:—Messrs. C. J. Bigger, Geo. Rollo, W. Glover, W. Esplin, T. F. Irwin, H. Moore, consulting engineers; S. W. Wiles, superintendent engineer (Messrs. Alfred Holt), Mr. Bowie (Messrs. Langlands), Mr. Cummings (Anchor line), S. Smilie, and others. The *Oporto* has been built to the order of Messrs. Fred Leyland & Co., by Mr. Charles J. Bigger, Foyle Ship-yard, Londonderry. She is constructed of mild steel to Lloyd's highest class, but she is considerably in excess of their requirements. Her dimensions are:—Length, 210 ft.; breadth, 27 ft.; depth of hold, 17 ft. She is fitted with a top-gallant forecastle, and a long bridge is placed amidships, under which are the saloon and state rooms. The saloon extends the full width of the vessel, and is very handsomely finished in solid oak panels with teak and walnut mouldings. The state rooms open off the saloon, and are provided with every convenience for the accommodation of a few passengers. The *Oporto* is schooner-rigged, and is fitted with two steel pole masts, the fore-mast being square-rigged. The main deck is of chequered iron plates, and great attention has been given to the deck fittings, which require to be of extra strength, so as to stand the heavy seas of the Bay of Biscay. The machinery of the *Oporto* has been fitted by Messrs. David Rollo & Sons, Fulton Engine-works, and has been constructed to the specification and under the superintendence of Mr. Neville Evans, the company's engineer. The engines are direct-acting, surface-condensing inverted cylinder compound, having cylinders 16 in. and 43 in. in diameter, the stroke being 36 in. Between the high and low pressure cylinders a heat-retaining apparatus has been fitted on the principle patented by Messrs. Ashlin & Turner. There is also fitted in the engine-room a Smilie feed-heater, and an evaporator by the same maker. The crank shafts are in duplicate halves on the built-up principle. The main boiler is 13 ft. 8 in. diam. by 10 ft. long, built of steel to the requirements of Lloyd's surveyors for a working pressure of 150 lbs. per square inch. There are two of Foxe's corrugated furnaces 47 in. diameter, and the funnel has been fitted on the double arrangement. Messrs. D. Rollo & Sons have also fitted a large horizontal donkey boiler on deck, and three powerful steam winches. The evaporator is arranged to act as a condenser for exhaust steam from the winches when working in port. The results achieved were highly satisfactory, the engines running at 70 revolutions, and giving 435 I.H.P., while the mean speed of the ship on the mile was fully 10 knots an hour, allowing for current. All on board expressed themselves highly satisfied with the vessel's performance.

Wileyside.—On June 26th the new screw steamer *Wileyside*, belonging to Wm. Milburn & Co., Newcastle, was taken on her trial trip. The vessel is built on the well-deck principle, and has been constructed by the Tyne Iron Shipbuilding Company (Limited), and engined by the North-Eastern Marine Engineering Company (Limited), her dimensions being 300 ft. by 38 ft. 6 in. by 23 ft. 3 in., moulded. The vessel was laden at the time of trial with about 3,700 tons cargo and bunker coals. It having been determined to take the trials at progressive speeds, the engines were first run at 38 revolutions, which gave an average speed of about six knots. At 70 revolutions the speed increased to eight knots; and at 80 revolutions close upon ten knots average was reached. These trials were considered highly satisfactory by the owners, being fully up to their expectations.

Fusilier.—On June 27th the new West Highland paddle-steamer, the *Fusilier*, went down the Clyde on her trial trip. She has been built by Messrs. J. M'Arthur & Co., Paisley, for Mr. David MacBrayne, and was launched in April last. The dimensions are:—Length, 200 ft.; breadth, 21 ft. 6 in.; and depth, 8 ft. 3 in. The *Fusilier* is of a neat design, having clipper bow, with handsome figure-head, and a finely-moulded stern, thus giving her an exceedingly smart appearance. There are large deck saloons, with a promenade deck above, while the dining-saloon, as usual, is placed under the main deck. All the usual conveniences requisite for passenger traffic are supplied, and the steamer throughout is fitted up in a very comfortable and tasteful manner. The engines were supplied by Messrs. Hutson and Corbett, Glasgow, and indicated about 900 H.P. The steamer will take up her station on the route between Oban and Gairloch, Ross-shire, proceeding once a week to Lochinvar. As she will have to encounter rough weather, particularly in winter time, the *Fusilier* has been constructed of specially strong plates for a passenger steamer, and has been otherwise strengthened to withstand rough usage. The measured mile was run, and a speed of 17 miles obtained.

Ibis.—On June 28th the *Ibis*, recently built and engined by Messrs. W. B. Thompson & Co., Limited, Dundee, was tried over the measured mile on the River Tay, when a speed of 13 knots was attained. The *Ibis* has been built to the order of the Cork Steamship Co., Limited, Cork, and is a steel vessel of 1,100

tons gross of the following dimensions: Length, 250 ft.; breadth, 32 ft.; depth, 15.40 ft. She is propelled by triple-expansion engines, having cylinders 21 in., 36 in., and 58 in. in diameter, with a stroke of 42 in. Steam is supplied by two steel boilers at a pressure of 160 lbs. per square inch. During the trial the machinery was found to work admirably, the power developed indicating 1,411 H.P. with 77 revolutions. The company included Mr. W. B. Thompson, for the builders, and Mr. F. C. Kelson, superintendent engineer, and Captain Croft, marine superintendent, representing the owners.

Oswestry.—On June 30th the *Oswestry* (s), recently built by Messrs. E. Withy & Co., West Hartlepool, for Messrs. Sievewright, Bacon & Co., of that town, went for her trial trip to Middlesbrough. After a test of the patent stockless anchors, and the adjustment of the compasses, the trip was commenced in a heavy sea, despite which adverse circumstance a speed of 12 knots per hour was obtained. The sea-going qualities of the vessel gave every satisfaction.

North Sea.—On July 5th the screw steam trawler, *North Sea*, recently launched by Messrs. Hall, Russell & Co., Aberdeen, went out to the bay for trial, and attained a mean speed of 11¼ knots per hour with the engines working very smoothly, the utmost satisfaction being expressed by all on board with the result of the trial.

George Baird.—On July 5th the new steam trawler *George Baird*, built by the Northern Marine Engineering Co., South Shields, to the order of Messrs. Baird & Barnsley, engineers, North Shields, made a successful trial trip. The following are the dimensions of the boat: Length, 81 feet; breadth, 16 ft. 6 in.; depth 9 ft. The engines of 25 N.H.P. were fitted by Messrs. Baird & Barnsley. The steamer left the New Quay, North Shields, and proceeded to the Coquet, calling at Amble. The trial trip was exceedingly satisfactory. The *George Baird* will be employed in the trawling and line fishing.

Aldborough.—On July 9th, this steamer, recently launched by Messrs. Russell & Co., Port-Glasgow, for Mr. Frederick Woods, of London, and engined by Messrs. James Howden and Co., Glasgow, had the official trial of her machinery. The *Aldborough* is a sister ship to the *Virginia*, by the same builders and engineers, the trial of which was noticed two months ago. She is 290 ft. by 38 ft. by 20 ft. 6 in., built to carry 3,600 tons dead weight on a moderate draught. Her engines are of the triple-expansion type, having three separate cranks, the cylinders being respectively 22½ in., 37 in., 58½ in. diameter by 39 in. stroke, the valves being on Howden's patent arrangement. Steam of 160 lb. pressure is supplied to the engines by two single-ended boilers 13 ft. in diameter by 11 ft. in length, having each three furnaces 3 ft. 2 in. diameter. The boilers are fitted with Howden's patent system of forced draught. The *Aldborough* steamed down the channel, first adjusting her compasses while cruising about, after which she was tried on the mile at Skelmorlie, when the runs with and against the tide showed a mean speed of 11·2 knots per hour, which was considerably higher than was expected. Owing to the propeller not being immersed sufficiently to take up the full power of the engines, only light firing and very mild use of the forced draught could be adopted to prevent continuous blowing off at the safety valves. The machinery throughout worked in a very admirable manner, and much satisfaction was expressed by the owners with the results obtained.

Jane Jolliffe.—On July 18th the steel screw steamer *Jane Jolliffe*, built by Messrs. John Readhead & Co., West Docks, South Shields, was taken to sea on her trial trip. The steamer is of the following dimensions, viz.:—130 by 22.6 by 12.6, is classed 100 A 1 Lloyd's, under special survey, and also has Board of Trade certificate for passengers. She is fitted with triple-expansion engines of about 150 N.H.P., also built by Messrs. John Readhead & Co., and is intended mainly for towing purposes on the Mersey, and for over-sea and foreign towages. There is considerable accommodation provided for crew and passengers in deck houses, &c., and the vessel generally combines every improvement securing efficiency and economy. The hull and machinery have been built under the superintendence of Mr. Thomas Grant, the owners' inspector. The owners are Messrs. W. & T. Jolliffe, of Liverpool, this being the fourth steamer of this class recently built for this firm by Messrs. Readhead. On the trial trip the results attained were extremely satisfactory, the engines working continuously during the trial, steam being easily maintained, and a mean speed of 12 knots registered on the measured mile. After several runs along the coast, the *Jane Jolliffe* returned to the river, and will leave for the Mersey in a few days.

Gotha.—On July 18th the *Gotha* (s.) was taken down the Humber on her trial trip. This ship has been built of steel to the order of the Yorkshire Coal and Steamship Company (Limited), of Goole, by Earle's Shipbuilding and Engineering Company (Limited), of Hull, for service between Goole and Hamburg. Her dimensions are:—220 ft. long, 29 ft. breadth, and 13 ft. 6 in. depth of hold. She is classed 100 A 1 at Lloyd's, and is fitted with topgallant forecastle, bridge, and poop, the passengers being accommodated amidships under the bridge. She is rigged as a schooner with two pole masts, and has a very convenient arrangement of hatches, winches, &c., specially adapted for the trade in which she will be engaged. Her engines are triple-compounds, working on three cranks, with cylinders 20½ inches, 31 inches and 54 inches diameter by 33 inches stroke, supplied with steam of 165 lb. pressure from a powerful double-ended boiler fitted with Henderson's patent self-cleaning fire bars. The compasses were adjusted off Grimsby, and a course was steered for Withernsea, where it was intended to put her on the measured mile, but owing to fog it was found impracticable to run her there. When the weather cleared the engines were opened out to their full power, and the speed tested by the patent log in slack water, the result of a considerable trip being a mean of 14½ knots, which was thought by the owners, engineer, and other representatives to be highly satisfactory, being greatly in excess of the contract power. Steam was easily maintained throughout the run, and there was an entire absence of heated bearings—in fact, the working of the machinery was most successful from first to last.

Sultana.—On July 19th the new steamer of the Bailey and Leetham Line, the *Sultana*, was taken down the Humber for a trial trip, and the results were satisfactory, inasmuch as a greater rate of speed was developed than had been anticipated. The ship was in splendid trim for a trial trip, as she was partly loaded, having on board some 1,700 tons of cargo and bunker coal, and drawing aft about 17 ft. 5 in. When the steamer had been under way an hour the speed registered on the patent log was rather over 11 knots.

Leon-y-Castillo.—On July 21st the new screw-steamer *Leon-y-Castillo*, built and engined by Messrs. David J. Dunlop & Co., Port Glasgow, to the order of Messrs. Elder, Dempster & Co., Liverpool, went on her trial trip. This steamer, a passenger and cargo boat to trade amongst the Canary Islands, has been constructed up to Lloyd's highest class. Her dimensions are:—Length, 190 ft; breadth, 27 ft.; depth of hold, 13 ft., with engines on the triple-expansion principle, designed by the builders. There is accommodation for 30 first-class and 24 second-class passengers. All the most modern appliances have been adopted in the fitting out of the vessel. Special attention has been paid to ventilation. The steamer is fitted throughout with electric light by Mr. Rankin Kennedy, of Woodside Electric Works, Glasgow. The installation consists of 63 lamps of 16-candle power each, distributed throughout the first and second class saloons and state-rooms, officers' quarters, engine-room, stoke-hole, 'tween decks, and large holds. The generating plant consists of one of Kennedy's double-cylinder single-acting engines, coupled direct to Kennedy's single-bobbin dynamo, and running at a speed of 350 revolutions per minute. In the way of patent machinery there is the steam-steering gear of Harrison, of Manchester; Harfield's (London) steam windlass, three steam winches, and apparatus for the introduction of a forced draught, with the view of keeping steam at a high pressure. The *Leon-y-Castillo* is fore-and-aft schooner-rigged, she has water ballast tanks in the fore-and-aft hold, and otherwise is a remarkably well trimmed vessel. She ran the measured mile several times, attaining a mean speed of 12½ knots, which is over the guaranteed speed. In the evening the steamer passed up to the dock of the builders at Port Glasgow.

ST. CATHERINE'S lighthouse in the Isle of Wight is said to have the most powerful light in the world. It is an arc lamp of 60,000 candle-power, the carbons being 2½ in. in diameter. The electricity is furnished by dynamos of the De Meritens type, driven by Robey engines.

A MARINE brake has been invented by M. Pagan, and was recently tested on the Seine. It consists of a cable having attached to it a series of canvas cones, which open out by the action of the water, and exert an enormous retarding force on the vessel. Thus the steamer *Corsaire*, running at a speed of 13 knots, was stopped by this appliance in seven seconds, 34 seconds being required when she stopped by reversing the engines without making use of the brake.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

THE MARINE ENGINEERS' UNION.

To the Editor of The Marine Engineer.

Sir,—Replying to the letter of "Experience" in your last issue. Surely that gentleman has misread my letter. I never said that marine engineers (chiefs or others) required "cramming." I maintained, not that marine engineers required "cramming," but that the "collective wisdom" (whatever that means) was somehow on the side of the 96 per cent. of marine engineers who had not joined the "Union."

From the first I have held, and shall continue to hold, the opinion that the "Union" did not adequately uphold the honourable profession of marine engineers, and surely, Sir, with this opinion ever before me, I would not think of "insinuating" that marine engineers were "usurping a position they had no right to." I still say that they have a right to a still higher position (both socially and professionally) than merely becoming members of the "Union" will ever confer on them.

As to my controversion of Mr. Leask's statement seeming "tame," "*tot homines, tot sententiæ*," and I do not undertake to please all. There is one part of "Experience's" letter I agree with, viz., "The survival of the fittest, &c.," and, having this in mind, why should it "be very wrong to enlighten people" by reading papers. Surely "the fittest" will survive the ordeal, even if they are "snubbed for their pains," which I very much doubt they ever would be.

I do not know that I need go into the other parts of "Experience's" letter, as it would be mere repetition on my part to do so.

I remain, Sir, yours obediently.

F. SEATON SNOWDON.

[With all due deference to our numerous and esteemed correspondents, we must beg that this correspondence now ceases, as we cannot see that any useful purpose will be served by its prolongation.—Ed. *M. E.*]

Reviews.

S.S. House Flags and Funnels. Sunderland: Thomas Reed & Co.

We have received from Messrs. Thomas Reed & Co., the well-known nautical and engineering publishers, of Sunderland, a copy of a very handy and useful little book just published by them, the scope of which is well set out in its full title, "The House Flags and Funnels of the English and Foreign Steamship Companies and Private Firms, containing in all 450 different flags, with an Alphabetical Index."

Whether placed in the hands of the yachtsman or the professional seaman, the book cannot but prove useful, for, given as they are in their true colours, any flags seen can be at once recognised on turning to its pages, and as in every case the name of the line or owner is printed immediately under each flag, there is no need for a tedious and time-losing reference to a numbered list; while, on the other hand, the alphabetical index permits of prompt reference being made to the flag and funnel of any particular line or owner; a second, or subsidiary, index classifying the flags and funnels of different ports. There is another use to which the book can and undoubtedly will be put, and that is as an aid to those who may require to design a new flag for their own use.

With so many differently designed flags afloat, the would-be designer of a new device is apt to become, unknowingly, a mere plagiarist; whereas had he these 450 coloured miniatures before him, he would not only be able to cull from them many valuable hints, but would be guided thereby in his final selection of a different design. Even to a landsman the book should prove, if not valuable, at least interesting, for there is (at least, so we have found with English landsmen) an ever-present interest in all that pertains to the sea. Like all Messrs. Reed's previous publications, the get-up of the book is good, while its moderate price (half-a-crown) places it within the reach of all.

Catalogue of Mathematical Instruments. London: W. F. Stanley, 4 and 5, Great Turnstile.

We now have before us the eighteenth edition of Mr. Stanley's illustrated catalogue of instruments, which is probably the most complete, and is certainly the most recent, of its kind issued.

The catalogue is embellished with many very good illustrations, and it appears to embrace prices and particulars of every thing needed by the architect, engineer, or draughtsman, from the humble drawing pin, at a few pence the dozen, to the magnificently-finished and supremely-accurate transit theodolite at £120.

The quality of Mr. Stanley's work needs no praise from us, the many medals and other honours received by him fully testifying to that; but it may interest our readers to know that since 1874, when the necessity of obtaining a quantity of uniformly good work compelled him to take the step, all the working parts of his drawing instruments have been made by machinery designed by Mr. Stanley, the "finishing," however, being entirely done by hand, while that part of the machinery used for dividing mathematical work and scales is now driven by steam, which Mr. Stanley claims produces greater accuracy and regularity than was formerly obtained by hand work.

Mr. Stanley took the gold medal at the Inventions Exhibition, and the *only* prize medal at the International Exhibition of 1862 for "excellence of construction of mathematical instruments."

Aide-Mémoire de l'Officier de Marine. Par Ed. Durassier. Paris: Librairie Militaire de L. Baudoin & Cie.

We have recently received a copy of this most useful French publication, which is got up as a handy-sized pocket-book, and forms a veritable *vade mecum* to all naval matters. In addition to giving fully the International Maritime Law, the book gives in full the names of all the vessels of the various navies, together with their dimensions, armaments, &c., in full. The artillery, coast defence, *personnel* of navy, &c., of each country is also given, and the book, taken altogether, is one which no naval officer should be without.

Miscellaneous.

Trial Cruise of an International Liner.—The *City of New York*, a new steamer of 10,500 tons, built and engined by Messrs. G. & J. Thomson, Glasgow, for the Inman International Steamship Company, arrived at the Mersey on July 23rd, after completing a run from the Clyde round Ireland and down Channel to Liverpool, a distance of 862 miles. She was delayed by fog on Saturday night not long after starting, but, the engines being three-quarter speed, developed 17,000 H.P., and she frequently covered 19½ knots. She leaves Liverpool on her maiden trip across the Atlantic on August 1st. Her engine power, when fully developed, is expected to exceed 20,000 H.P., the diameter of the cylinders being as follows:—High pressure, 45 in.; intermediate, 74 in.; and low pressure 113 in.; all with a stroke of 60 in. Steam of 150 lbs. pressure is supplied by nine steel boilers, each having six corrugated furnaces, the forced draught being on the closed stokehold system. During the trial she was run twice on the measured mile, and realized a speed of 19·77 knots on the first run, and 20·2 knots on the second, with an I.H.P. of 18,500.

On July 25th an important addition was made to the Royal Navy by the delivery from the contractors of the new first-class battleship *Sans Pareil*, which has been built for the Royal Navy by the Thames Ironworks Company. The *Sans Pareil*, which arrived at the Nore on Tuesday night, was handed over to the charge of the Medway Steam Reserve authorities, and will be at once completed for sea. She is ordered to be equipped with two 100-ton, one 30-ton, and twelve 6in. 5-ton breech-loaders; twenty-one quick-firing 3 and 6 pounders, eighteen Whitehead torpedoes, and an equipment of machine guns. The *Sans Pareil* has a displacement of 10,470 tons, and is fitted with engines of 12,000 horse power. She and her sister ship, the *Victoria*, are the most powerful vessels ever built for the Royal Navy, with the exception of the *Nile* and *Trafalgar*. The total cost of the *Sans Pareil*, when fully equipped and ready for sea, is estimated at £814,000.

The *Roseale*, an iron ocean-going steamer, has been the first to make the passage between London and Chicago, proceeding up the St. Lawrence, and through the Ship Canal to the lakes. Though a certain amount of her cargo had to be removed to permit her to pass through the St. Lawrence Canal, yet the vessel was still drawing 14 ft. on her arrival at Chicago.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from June 15th to July 12th, 1888.

8756 J. Price, jun. Dredging apparatus.
8841 F. O. Ferguson. Propelling and steering boats.
8845 P. Evans. Screw propellers.
8852 J. E. Hall. Consuming smoke and economising fuel in steam boiler furnaces.
8900 J. S. Christopher. Compass needles.
8902 Boult (S. Bond). Securing vessels' hatches.
8942 J. Howden. Feed, heating, and supplying apparatus for
8985 S. J. Tucker. Screw propellers. [steam boilers.
8986 J. Wilson. Propelling vessels, &c.
9021 A. MacAndrew. Ships' sails.
9026 J. H. Carson. Boats.
9056 W. Scotson. Prevention of corrosion of propeller blades.
9069 J. C. Dobbie. Mariners' compass.
9092 J. Lawson. Signalling at sea.
9134 M. Delmard. Projectiles.
9143 F. W. P. Bouverie and W. Balch. Discharging signal and other rockets.
9153 Lake (D. Donahue). Separating oil from the feed water of steam boilers.
9220 W. Smithson and W. Pickup. Engine governors.
9229 E. Whiteley. Automatic steam and water-reducing valves.
9290 J. Rankine. Supplying feed water to boilers.
9291 C. Spinks. Ships and propellers. [vessels' course.
9293 Hat Chase. Indicating movements of compass needles or
9337 W. M. Jackson. Marine propulsion.
9340 G. Wald and E. Rigal. Propulsion on water, land, &c.
9349 J. W. Waller. Sliding seats for rowing boats.
9373 S. T. Osborne. Life saving apparatus for use at sea.
9394 Letellier and Grandin. Dredging apparatus.
9395 do. do. do.
9398 F. Hargrave. Signalling at sea.
9443 Haddan (A. Q. Montserrat). Water supply in harbours, &c
9451 J. A. and J. Hopkinson. Stop cocks.
9458 H. Burrell. Tables for use at sea.
9508 W. France and R. Morgan. Ships' telegraph apparatus.
9514 E. Solomiac. Torpedo defence nets.
9537 Baldwin (D. McGill). Engine lubricators.
9543 E. J. Preston and E. W. De Rusett. Side scuttles and port lights for ships.
9548 C. Howe and J. H. Beckwith. Distilling water and and feeding boilers.
9561 A. Greig and A. C. Franklin. Ships, boats, &c.
9566 W. Malcolm. Shipping coal, &c.
9573 W. Vero, jun. Life saving buoys, floats, belts, &c.
9583 Allison (W. E. Crist and T. Hawkins). Packing plates for engine pistons.
9587 F. Wade. Utilising tidal power. [engines.
9596 Boult (J. H. Venables, J. Hughes, and S. Coxon). Rotary
9603 A. Languet. Excavating or deepening water courses.
9610 J. J. Prins. Compound engines.
9638 J. Prooter. Supplying fuel to furnaces.
9652 Lake (O. B. Peck). Generating steam.
9674 Newton (C. C. Worthington). Direct acting duplex engines.
9698 G. Rockliffe and W. Key. Boats' davits.
9714 P. H. Papps. Double, triple, &c., expansion engine valves.
9739 J. P. Gibbins. Submarine mines.
9740 Ditto Sea and land mines.
9753 J. Stanfield. Floating docks.
9771 T. Leitch. Screw propellers.
9777 E. Maertens. Centrifugal pumps.
9778 Ditto Pumps.
9818 G. Quick. Ordnance.
9820 E. B. Donkin. Metallic packings.
9841 W. James. Sight feed lubricators.
9846 T. E. F. Ogden and W. Ireland. Steam boiler furnaces.
9870 D. A. Murdoch. Variable expansion valve-gear.
9890 W. B. Cumming. Steam jet apparatus.
9892 W. Hargreaves and W. Inglis. Compound steam engines
9926 T. Bassnett. Ships' compasses. [and boilers.
9954 H. N. Morgan. Torpedo.
9958 E. Jones. Steam engine governors.
9961 M. E. Hall. Torpedoes.
9972 S. N. Knight and I. P. Lambing. Dredging machines.
9999 G. E. Sergent. Screw propellers.
10002 J. Nickholds. Propulsion of boats, ships. [vessels.
10028 W. R. G. Roebuck. Indicating position of foundered
10046 A. McCrackin. Boat detaching apparatus.
10049 G. E. Posgate. Masting and rigging ships.
10053 W. J. Reynolds. Marine compasses.
10061 D. Adamson. Guns and other ordnance.
10067 F. W. Willcox. Screw propellers.
10074 G. Spencer. High steam and low water safety valves.
10082 Thompson (H. F. Schwartz). Saving life from drowning.
10101. J. V. Peichl. Ships' compasses.
10128 K. J. Rae. Ships' windlasses and capstans.
10148 J. W. Howard. Journals and bearings for lubrication
[boats.
purposes.
10159 J. Martin. Ships' mattresses convertible to collapsible
10164 T. Holehouse. Engine valve-gear.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1 C, denotes First Class; 2 C, Second Class.

June 23rd, 1888.

Bartlett, Joseph 1C Cardiff
Berry, James ... 2C Aberdeen
Bower, Charles.. 1C Liverpool
Challinor, Henry 2C Liverpool
Clarkson, Harold 1C N. Shields
Cook, John .... 1C Glasgow
Cruickshank, J. 1C ,,
Dixon, Henry W. 1C London
Drummond, R. 1C Glasgow
Duff, Thomas H. 2C ,,
Elder, Joseph ... 2C Liverpool
Emslie, James .. 2C Aberdeen
Ewing, John .. 2C Glasgow
Fairley, Alex. .. 2C ,,
Ferron, Nicholas 2C Cardiff
Foulds, Matthew 2C Glasgow
Harris, Charles.. 1C ,,
Hender-on, A. .. 2C Aberdeen
Henderson, J. .. 2C Glasgow
Hill, Wm. Henry 1C Cardiff
Hyndman, Alfred 2C ,,
James, J. E..... 1C ,,
Kirkwood, G. .. 2C Glasgow
Lamb, David .. 2C London
McCall, James .. 2C Liverpool
McIntyre, James 2C Glasgow
McNaboe, John 2C London
McNaught, J. .. 2C Liverpool
Pichie, James S. 2C Glasgow
Pryor, Frank .. 2C Cardiff
Rafferist, D..... 2C ,,
Raife, Thomas P. 1C ,,
Redman, Charles 2C ,,
Robertson, David 2C Glasgow
Robson, D. M... 1C N. Shields
Robson, Robert 1C Cardiff
Shearer, David.. 2C Glasgow
Skinner, John .. 2C Aberdeen
Stephens, W. H. 2C Liverpool
Stewart, John W. 2C Glasgow
Swan, Thomas D. 1C N. Shields
Wales, Fredk. J. 2C London
Wall, George .. 1C ,,
Watkins, Charles 2C Cardiff
Weir, John G. .. 1C Glasgow
Wyndham, Thos. 2C Cardiff
Yates, Alexander 1C Glasgow

June 30th, 1888.

Baker, Frank .. 2C Cardiff
Binfill, Chas. F. 2C ,,
Cobbins, John O. 2C Hull
Cox, James B. .. 2C Liverpool
Curnow, Thomas 1C London
Daisy, Thomas.. 2C Liverpool
Dixon, A. G. J. 2C London
Downs, Charles 2C ,,
Embley, Robert 1C Hull
Fraser, Andrew 1C Cardiff
Hosgood, W. J. 2C ,,
Magee, John.... 2C ,,
McCleanahan, H. 1C Liverpool
McPhee, Thomas 2C London
Meriton, T. H. R. 1C Sunderl'd
Miller, Robert .. 1C London
Moseley, George 2C Sunderl'd
Murphy, Thos. J. 1C ,,
Nicholson, R. A. 1C ,,
Pain, Edward A. 2C ,,
Raynor, John B. 1C Liverpool
Sanbrook, Wm. 1C Cardiff
Sheppard, H. A. 1C Liverpool
Smith ..... Sunderl'd
Stewart, Wm. W. 2C ,,
Syme, Henry .. 1C Liverpool
Taylor J. M'Lean 2C London
Thomas, Edward 1C Cardiff
Thomson, George 2C London
Tyson, Thos. W. 2C Sunderl'd
Walker, Alf. O. 2C London
Willis, Robt. F. 2C Liverpool

July 7th, 1888.

Bethuna, K..... 2C Glasgow
Bishop, Geo. F. 2C N. Shields
Cooke, Richd. P. 2C ,,
Crichton, Robert 2C Glasgow
Dowair, Andrew 2C ,,
Hamilton, H. T. 1C London
Handyside, C. B. 1C Liverpool
Hislop, John.... 1C Glasgow
Hock, M. A..... 1C Liverpool
Hudson, John .. 1C N. Shields
Lowe, Arthur H. 1C N Shields
Phenna, John H. 1C Liverpool
Philip, Benjamin 2C ,,
Ramage, Robert 2C Glasgow
Reid, Alexander 2C ,,
Robertson, John 1C ,,
Scullard, Ed. C. 2C N. Shields
Thompson, A. B. 2C Liverpool
Todd, James.... 2C Glasgow
Wilkie, Andrew 2C Liverpool
Wilson, Robt. M. 2C ,,
Winchester, A. 1C Glasgow

July 14th, 1888.

Ake, John Wm. 1C Hull
Barnes, Thomas 2C Liverpool
Boyes, Mark G. 1C London
Brown, Andrew 1C Leith
Burnet, D. T. .. 1C ,,
Campbell, Gilbert 2C London
Conway, H. P. 1C ,,
Crockatt, J. G. 2C Dundee
Ellis, W. A..... 2C Leith
Gibson, James B. 1C Liverpool
Goninan, Alfred 2C London
Lindsay, James 1C Leith
Mace, John C. .. 1C Liverpool
Marshall, John.. 1C Dublin
Powell, A..... 2C London
Purvis, A. A. ... 1C ,,
Thomas, Henry 2C ,,
Thearle, Thomas 1C ,,
Whyte, Wm. .. 2C ,,
Wightman, J. S. 2C Leith
Wimshurst, H. J. 1C Liverpool

The Marine Engineer.

LONDON, SEPTEMBER 1, 1888.

EDITORIAL NOTES.

AT the meeting of the Institution of Naval Architects in July, an interesting paper was communicated by Professor Henry Dyer, C.E., upon the history of the marine engine. He pointed out an interesting fact, which is probably known to very few, that in 1788, just a century ago, there appeared an account in a Scotch newspaper of a boat which was put in motion by a steam engine upon a private piece of water belonging to Mr. Miller, of Dalswinton. He successfully propelled a boat 25 ft. long by 7 ft. broad with paddle-wheels and a small engine, the cylinders being only 4 in. in diameter. As a result it is stated that the vessel moved delightfully, and travelled at the rate of 5 miles an hour, to the pleasure of the projector and the astonishment of the country people, who assembled from all quarters to witness the wonders of a boat driven by "reek." We thus have reached the centenary of the marine engine, and, curiously enough, also the jubilee of trans-oceanic steam navigation, 1838 being the year in which the *Sirius* and the *Great Western* crossed the Atlantic. The credit for the design of the engine and boat used at Dalswinton appears to be jointly due to Patrick Miller, James Taylor, and William Symington, who was the designer of the engine; and Mr. Scott Russell, after patient investigation, has come to the conclusion that the art of steam navigation was the joint invention of the three men named, and to their efforts the world owes its present advantages. These same three men soon followed with a second steamboat in the course of the next year, with a boat 60 ft. in length and cylinders 18 in. in diameter. An increased speed of nearly 7 miles an hour was obtained, but the boat was too slight in build to be used permanently for traffic. Robert Fulton, an American by birth, took up the subject in about the year 1801, and in 1803 completed a steamboat which was tried on the river Seine. The machinery was, however, too heavy for the vessel, which broke in two and sank to the bottom of the river. The machinery was recovered and the hull reconstructed, but only 4½ miles an hour in speed was obtained. Disappointed in receiving aid from the French Government, he crossed over to England, and in 1807 launched a vessel in America, with a Watt engine fitted in it to propel it. This was the largest steam-vessel that had hitherto been constructed, being 133 ft. long, 18 ft. broad, and 9 ft. deep, and ran 300 miles on its trial in 62 hours, which would appear to be the first voyage of considerable length ever made by a steam-vessel. In 1812 he designed the first steam-vessel of war, measuring 2,475 tons, 156 ft. long, 56 ft. broad, and 20 ft. deep, which was considered a very large vessel indeed. On her trial trip she steamed 53 miles in 8 hours 20 minutes, and, when fully loaded with her armament, she made 5½ miles per hour. In the meantime Henry Bell, of the Clyde, was following up the first experiments of Miller, Taylor, and Symington, but without commercial success. An engineer, John Thomson, of Glasgow, who had been associated with Mr. Bell, eventually parted from him, and with the association of John Wood, of Port Glasgow, built the *Elizabeth*, a vessel of 51 ft. keel, 12 ft. beam, and 5 ft. deep, which made an average of 9 miles an hour, and was thus the first remunerative steam-vessel in Great Britain. After this, improvements were rapid and of substantial commercial value, regular packets being established by 1818, the names of Wood, Steel, Scott, Denny, and Caird, of the Clyde, being pre-eminent as the builders, and David and Robert Napier as the engineers. The construction of the *James Watt* in 1822 marked a decided step in advance, as she had a speed of 10 miles an hour, and was engined by Boulton and Watt. One or two voyages had by this time been made across the Atlantic, but it was not until 1838 that steam transatlantic navigation was proved to be commercially successful. From this date many large steamships, both of commerce and war, were built in rapid succession, and well-known lines were established. The side-lever engine was employed almost entirely for the first twenty years in the larger mail packet companies, and was essentially Watt's engine. They were magnificent specimens of engineering construction, but were far from being self-contained, the keelsons and framing of the vessels being largely relied upon for resisting stresses. The steeple engine, introduced by Messrs. Napier, was used for some years, until superseded by the diagonal or oscillating engine. The introduction of the screw propeller rapidly modified the construction of the engines, the first steamer of any size fitted with the screw propeller being the *Archimedes*, built on the Thames in 1839. The *Great Britain* was one of the most conspicuous examples of early screw propellers. She was built in 1843, and was the largest vessel of that day; was constructed of iron, and propelled by a screw. She was designed by Brunel, and her engines were made by James Penn and Sons, the engines, however, being secured to the propeller-shaft. The *Great Britain* made her first trip across to

New York in 15 days. Up to this time, however, little attention had been paid to economy of fuel; but after this period the economy in fuel was thenceforward the most remunerative field for invention. Compounded engines were first introduced by Randolph, Elder & Co., in the screw-steamer *Brandon*. She made her trial trip in 1854, when her consumption was found to be about 3¼ lbs. per I.H.P. per hour. Previously the rate had varied between 4 and 4½ lbs. From this point onwards the modifications are within our recent knowledge—from compounded engines to quadruple-expansion engines, from steam pressures of 20 and 30 lbs. per square in. up to above 150 lbs.; but we have scarcely space to follow these later and more modern developments, which must be well known to our readers.

THE question of applying the compulsory test for colour blindness, in addition to officers in the mercantile marine, to all able seamen, who frequently occupy the responsible positions of "look-outs," is of particular interest to marine engineers and their no less necessary helpmates, the firemen. In these days of exceptionally fast steaming, both in the coasting and transatlantic passenger services, all suggestions that can reasonably be introduced and passed into law in Parliament, tending to mitigate loss of life and property at sea, should be hailed as blessings by those who go down to the sea in ships, more particularly by those who are "cribbed, cabined, and confined" in the engine-room, where there is the least possible hope of escape in the event of an accident. It is satisfactory, therefore, to record the fact that since the appearance of our last issue the subject of extending the compulsory colour test to "look-outs" has been discussed in the House at Westminster. It is equally satisfactory to find that our nautical contemporaries are agitating for an alteration of the law. Our readers will remember that in 1877 the Board of Trade decided that all candidates for examination for masters' or mates' certificates should first pass a test examination as to their ability to distinguish the colours which enter largely into the combinations of signals by day or night used at sea, namely, black, white, yellow, blue, red, and green, the last two more particularly, as representing the port and starboard lights. The test is conducted by the examiners in navigation and seamanship at all ports where there are local marine boards, and by certain officers of the Board of Trade at ports where the former are not located. Down to February, 1880, the result of failure to pass these apparently simple tests was equivalent to that of failure to pass the ordinary examination in navigation and seamanship. This is so to the present day, but since that date the Board of Trade allowed any person serving or about to serve in the mercantile marine the option of testing his ability to distinguish colours correctly for the small fee of five shillings. Glancing at the Board of Trade's latest statistics, we find that the number of those ascertained to be colour-blind is one out of every two hundred. At first sight these figures do not appear very alarming, but when it is remembered that were it not for the *compulsory* examination, any one of those candidates so rejected might have occupied a position, holding, as it were, the ship and all the souls on board solely on the imperfect judgment of his eye, the consequences can be readily imagined. Again, it was startling to read in this departmental publication that in the apparently simple test in which the candidate is requested to describe the colour of a light exhibited in a dark room, the green was pronounced red in 107 instances out of 189! The danger, therefore, is no myth, though a few individuals, who have not given the subject due thought, consider that it is much exaggerated. It would be extremely interesting to obtain a synopsis of opinion from all the shipowners of the United Kingdom as to whether they now consider the time has arrived when the compulsory test in colours should be applied to seamen. In the absence of this it is satisfactory to mention that the vast majority of the Liverpool owners have recorded their conviction that a colour-blind man is unfit to be a "look-out." This may, perhaps, be accepted as a criterion of the opinion of all the shipowners. We know of nine boys who were within the last three years stationed on one of our numerous training ships, and were declared colour-blind. They eventually joined the merchant service. This is a very cheering "look-out." Would space but permit, we could record cases of colour-blindness galore among our seamen, and, what is still more to the point, positive facts illustrating instances of collisions that might have occurred, through the inability of the "look-out" to distinguish red from green, but for the prompt intervention of a second person not so afflicted. We would point out that the regulation side-lights on a vessel should be recognised in clear weather at a distance of two miles, and that in the case of two vessels meeting at night, they can get little or no indication of their relative positions until within that distance. If the night is not clear, or the lamps badly trimmed, the distance at which the green and red lights are visible is greatly diminished. Supposing two steamers each going at the rate of 20 miles an hour, they would meet in about three minutes after the lights were discernible.

It will be admitted that this is little time enough to alter the course of a vessel in the event of a mistake. Nothing can be lost, while everything is to be gained by bringing all sailors under the compulsory test, and not leaving the matter to their option as at present. Mr. W. H. White, Chief Constructor to the Navy, a few days ago publicly referred to the bravery of our sailors, and added "it seemed to him that the engineer who stood in the engine-room, and the fireman who stood in front of the furnaces, without knowing what was happening above, carrying out the orders given from the deck, were as brave men as there were on the ship. . . . Those who were engineers and stokers made for the national greatness as much as those who command and navigate the ship." We fully endorse that truth, and ask that every possible protection be granted them. "To be or not to be" is the question sooner or later to be decided regarding the compulsory test to sailors. All interested in the prevention of loss of life and property on the great highways of the ocean must emphatically plump for "to be."

One of the subjects about which least is known in the armaments of the present day, is the effect in actual practice of the new high explosives which are being tested for shell purposes. Captain C. C. P. Fitzgerald, R.N., has given such information as may be got together from the little publicly known of these explosives to the Institution of Naval Architects. He points out that our neighbours across the Channel have been for some time experimenting with an explosive substance called melenite, but they envelop their results in such a cloud of secrecy that little is known except that, in the case of melenite, it has been practically proved that shells filled with it can be fired without disastrous explosion of the shell within the gun. The explosive force of melenite is about equal to guncotton, weight for weight; but as melenite is much denser than guncotton, about half as much again of melenite as of guncotton can be placed within a shell, and thus give a proportional increase of explosive force. The distinctive effect of the highly explosive shells is, that whereas a shell loaded with gunpowder will pass through the side of a vessel and explode beyond, the more highly explosive melenite shells are said to burst actually on contact, so that the destruction caused is out of all proportion greater, many square yards of the side being actually blown away. There is one point for satisfaction as regards defensive power against such a shell, that it is said that comparatively thin protecting armour will cause the break up of the melenite shell without penetration. It is a curious fact that the French have always been able to lead, as compared with ourselves, in the development of novel ideas. They had the first steam three-decker, the first ironclad, and were years ahead of us in heavy breech-loading guns. We have been glad in years gone by to copy the models of their sailing ships, which were acknowledged to be superior to our own, and Capt. Fitzgerald consequently points out that they are well worth watching in whatever experiments they may be carrying on. It might appear that the introduction of high explosives in shell may render turrets and ship batteries so untenable for the gunners, by the greater number of chances of penetrating through some vulnerable part or opening, that it may lead to an entire change of front in the construction of heavy guns and armaments with their slow fire. A heavy gun is of very little value in actual warfare, if the gunners cannot stand to it to work her. The concentration of the armour in places has tended also to expose a larger area capable of penetration by explosive shell of small calibre. It is understood that experiments are about to take place with the *Resistance* in the connection of highly explosive shells, and it would be well that the results should be rendered as fully known as possible.

Seizing the opportunity of the presence, for the second time, of the Institution of Naval Architects at Glasgow, Professor Jenkins read before them a most interesting paper as to the course of instruction in naval architecture at Glasgow University. The cry of the present generation for better technical education has certainly borne fruit, and there are few arts or professions in which the highest class of education, in almost any subject, cannot be obtained. There is, undoubtedly, a large section of naval architects who prefer using their talents and time in the valuable market of private enterprise rather than in the royal dockyards, and to meet the wants of students qualified for the private trade the John Elder Chair of Naval Architecture, including marine engineering, was established in 1883. With these classes Dr. Elgar was for some time associated, and Professor Jenkins seems to have worthily and energetically followed his labours. A fair number of students now regularly attend both the day class and the evening lectures, and it is sought there to confer upon the students a sufficiency of theoretical knowledge to enable them to become worthy and capable naval architects. One difficulty that has been sensibly felt is, that students who have not previously spent some little time in a shipyard cannot expect to receive as much benefit from the course as those who have become familiar with the details of ship-construction. As far as possible

this difficulty is met by the evening class for those who have been occupied in the day; but it is thought desirable, by the University authorities, that students having the opportunity of giving the day to their studies should be occupied for part of the year practically in the dockyards. The instruction includes all methods of determination of the centre of gravity and the centre of buoyancy under most conceivable conditions, and, as a consequence, determination of the meta-centre and meta-centric diagram. Those students who can work in the day also are practically taught to lay off the fore and after body of iron-sailing vessels. In a second session, the strength of ships and the stability of ships is taken up; and in a third session the course terminates with problems on the stability of ships, the geometry of ships, trochoidal and other waves, the resistance of ships and ship-design. Professor Jenkins suggests that it would be well that sons of shipowners, as being interested in shipping property, should become acquainted with the laws and properties of the ships which form the basis of their livelihood, as, up to the present time, the classes have been attended only by students who propose becoming naval architects or marine engineers. It is suggested that, were the shipowners better acquainted with the laws of stability and properties of the vessels they desired to have built, there would be less conflict between the wishes of the shipowner and the difficulties of the ship-designer.

Mr. James Deas, C.E., Engineer of the Clyde Navigation, has communicated to the Institution much valuable information as to the history of the improvement of the river Clyde. These improvements have served to raise Glasgow, within the short period of less than a century, from a second-rate inland provincial town to be the second city of the empire, and the chief seaport of the West of Scotland. All credit is due to the energetic enterprise of the Corporation of Glasgow and its townsmen for the long-sighted policy that has attended the enormous sums expended in the improvements of the river. Had their enterprise not been so well expended, the Clyde would by this time have been almost choked to a distance of many miles below the city of Glasgow. Golborne, Rennie, and Telford have their names associated with the successive works effected in the river for confining the water and increasing the ebb scour, and the removal of hard shoals by dredging. The Clyde Trustees, after 1836, treated the whole subject with a truer appreciation of its future under the designs of James Walker. Though a great deal has been done by training walls or parallel dykes, it appears that to persistent dredging the enormous increase in the depth of the river since 1840 is due. The system of dredging by steam power and the carrying of the dredged material to sea by hopper barges has proved the secret of the rapid enlargement of the Clyde, the Tyne, and the Tees. The removal of Elderslie rock, a huge vein of trap, which extends across the river a short distance above Renfrew, must be mentioned as an important item in the clearing of the river. This was by no means a trifling undertaking. To carry out the blasting away of the rock, some 16,000 holes were bored, and 110,000 tons of whinstone and boulder clay were dredged away. Under such circumstances the Clyde Trustees naturally possess a powerful dredging plant with which they are constantly at work, maintaining the bed of the river in a high state of efficiency. It is to the successful development of the river, and its harbour accommodation in Glasgow itself, that the enormous increase in the tonnage cleared at present from that city brings so considerable a revenue to the Clyde Trustees in rents and dues, which now amounts to nearly £300,000 per annum.

SLIDE VALVE GEARS.*

DISCUSSION.

The Secretary said he had received a communication from Mr. Weir (of Messrs. Ramage & Ferguson, of Leith), together with a working model of the valve gear alluded to in the Communication, and if it was the pleasure of the meeting he would read it before anyone rose to speak on the paper. ("Agreed.")

Mr. J. Weir wrote:—I have read with pleasure the proof copy of Mr. Milton's paper on the subject of Valve Gears. I would remark, however, that *Engineering* of September 17th and October 8th, 1886, contain an interesting article on "Radial Valve Gear," treated in exactly the same way as Mr. Milton now does; in fact, the motions of the very gears he mentions, viz., Hackworth's, Marshall's, and Joy's are severally investigated by the aid of the Zeuner diagram, "further, it is shown that all radial gears are kinematically one and the same gear although modified in detail to accomplish certain ends, and that their seemingly complex motions open up before the pass-key of the Zeuner diagrams, so that with the aid of the diagram a designer can handle the most complex of compound radial gears as easily as the simplest arrangement with fixed eccentric." It would have been more interesting to the members of the Institution, and to engineers generally, had it been allowable to discuss the merits or demerits of the several valve gears illustrated, as much can be said for some of them while equally much can be said against others; but this would obviously be out of place seeing no particular gear is brought forward in the paper. A very important requirement, in a valve gear for marine engines, not mentioned in the paper, is its readiness to adapt or lend itself to the general arrangement of the engine. The author of the article in *Engineering* already referred to, calls attention to the willingness of engineers of late to adopt new and apparently complicated forms of mechanism for imparting motion to the distribution valves of the steam engine; but the secret of this is to be found more in their adaptability to the arrangement of engine than to the theoretically perfect results which are aimed at and which are more or less accomplished. My more immediate object in addressing this to the Institution is to bring before the members a valve gear not mentioned by Mr. Milton, which fulfils all the conditions laid down by him as essential for marine engines,

* Read at the North East Coast Institution of Engineers and Shipbuilders.

with the further qualification laid down by myself, viz., its adaptability to general arrangement. I have no personal object in view in doing this, the valve gear is not patented like those described in the paper, although some of them have very slender claims to be called patent, indeed, if careful investigation were made, would be found to be entirely invalid. I submit a model of the valve gear for the inspection of members. The model itself may require some apology, it is rough and was made in a hurry to illustrate the gear to the owners of two steamships which my employers (Messrs. Ramage & Ferguson) had contracted for. It is to a 3-in. scale, and is arranged for the high-pressure engine, steam being admitted to the inside edge of the valve; for the other engines, where steam is admitted at the outside edges of the valves, the valve spindle is beyond the centre of the slide connecting rod. Those who are familiar with Zeuner's treatise will at once identify the model as being practically the gear described therein as Waldegg's. In its present form it is known as the "Walschaert Valve Gear," and is largely employed by Continental locomotive engineers, and has been fitted by English locomotive builders at the request of their foreign customers. I cannot find any trace of it being employed for locomotives in this country. The gear is of the compound type, the valve receiving its motion partly from the piston rod and partly from a single eccentric placed at right angles to its line of motion: the eccentric may be close up to the side of the crank, or outside of the bearing next the crank—in other words, the piston rod moves the valve through its external lap and lead, the eccentric giving the opening to steam. As will be seen from the model, the gear gives constant lead at all grades of expansions, or can be set otherwise in the same way as Mr. Milton describes for Marshall's gear. There is a difference in amount of opening at top to opening at bottom, but not to such an extent as to necessitate an extra port on the top. The reversing is accomplished by moving the slide connecting rod to the opposite end of the radius link. The distribution of steam is exactly the same at both ends of the cylinder, or may be varied at will. The motions of the gear can be investigated and analysed by the aid of the Zeuner diagram in the way Mr. Milton describes for the other gears. In Zeuner's treatise a theoretical diagram and description is given. I had hoped to supplement this by the actual diagram, but I have not had the time at my disposal. The obliquity of the rods plays a most important part in this valve gear in controlling the movements of the valve. In this gear it is quite correct to speak of the dwelling action of the valve, as can at once be noticed on the model, but more clearly by comparing eliptical diagrams in which the stroke of piston is abscissa and travel of valve ordinates. The history of the gear in so far as it is has been applied to marine engines is brief. Two years ago my employers fitted it to a small engine; it was highly successful. The engine, with indicator diagrams, was subsequently illustrated in *Engineering*. At that time we were under the impression we were the only firm using the gear, but it turned out that Messrs. Denny & Co., Dumbarton, had also used it; quite recently I learned that Messrs. R. Napier and Sons has also fitted it. In view of bringing this before the Institution I placed myself in communication with these two firms. Mr. Kirk writes that he fitted the gear to the two ironclads *Australia* and *Galatea* recently built by his firm for the British Government. Mr. Brock writes that three years ago he fitted the gear to three vessels for the British India Co.; from then till now he has also fitted about fifteen sets of engines, ranging from 300 to 4,000 indicated horse-power. Mr. Brock has now on hands ten further sets, the power ranging from 400 to 6,000 indicated horse-power. My employers now fit the gear to the exclusion of every other gear, and up till now have fitted ten sets, all triple-expansion engines ranging from 150 to 1,300 horse-power indicated. As I have already said, its history, so far as marine engines are concerned, has been brief, but none of the gears mentioned in the paper can show such a record in such a short space of time; which I think of itself is a sufficient guarantee of its utility for marine engine purposes. The strains are all direct, easily calculated, and in no case exceed the direct load on the valve to any appreciable extent; the number of working parts are more than in Marshall's or Hackworth's gear, but the summation of the goodness of any valve gear is not in its fewness of working parts, more especially when those parts are not subject to any severe strain. If there is nothing else to recommend the gear to manufacturers, there is in its immunity from patent royalty, which for one of the gears mentioned in Mr. Milton's paper amounts to 10s. per nominal horse-power, a considerable sum for 6,000 indicated horses. I also send you an engine design with the gear fitted (Figs. 36 and 37); and as I have made this gear my special study, I will be only too glad to communicate to anyone the results of my experience with it.

Mr. F. C. Marshall, with the view of opening the discussion, said he should like to make one or two remarks in connection with this paper, perhaps rather more of a personal and explanatory character than at all attempting to go into the questions that Mr. Milton had so ably raised as to the advantages and disadvantages of the various gears and the strains to which they were subject. He would only say, by the way, that he regretted to find that the diagrams of stresses had not been put up on the wall that night. Mr. Milton had alluded to all the systems of valve gear to which his (Mr. Marshall's) name was attached, and, perhaps, like the dog that had got a bad name, names got attached to things, without, perhaps, having much right to them. He wanted distinctly to explain that any valve motion attached to his name was derived from the Hackworth motion. The only novelty he thought he had introduced, and for which he foolishly took out a patent, was for a swinging movement instead of the sliding movement which Mr. Hackworth invariably introduced. So far as he knew there was nothing of that kind in Mr. Hackworth's original machinery. It was, as Mr. Milton described, a simple angular slide in which the end of the eccentric rod or lever travelled, and by reversing the position of the guide allowed it to travel up in one way or another, and thus he got his motion. In order to avoid the difficulties of sliding surfaces, and making a gear that would simply be one of pins and bushes, working joints that would easily be repaired, turned, and bored, he (Mr. Marshall) adopted this motion. In thinking it out he found that the port opening at the top was very much less than the port opening at the bottom, and he introduced an additional steam port at the top end of the cylinder, and so got a large steam opening equal to that of the lower port; for he need not say that with great velocity of piston and of revolution it was not desirable to increase port openings or travel of valve to any greater extent than they possibly could help. Whether this was a new system or one similar to Mr. Hackworth's, fortunately it had been a very great success; and seeing it had many advantages, was so very easy to apply, and there was not a penny of royalty attached to it—it was free to the whole world to use—he was surprised so few engineers availed themselves of its advantages. With regard to the second form of it, Fig. 20, page 158, and Fig. 27, page 122, which he (Mr. Marshall) called the unfortunate form for the reasons explained by Mr. Milton, viz., in one of the movements on which there was the greatest motion, they had two-and-a-half times greater load than was needed, and that had sometimes led to disastrous results. This second motion had his name attached to it for the very reason that, having patented one thing, he thought it desirable to patent another application of it in order to secure the rights of it. He had not made more than half-a-dozen sets of engines with this application when a gentleman from Germany, of the name of Klug, came in upon him with heavy demands for having infringed his patent. He (Mr. Marshall) told him he was not aware of it, and then he was shown this same valve motion. He told him he was very much surprised; that they would consider it, and perhaps come to some arrangement; that they were going on making it, however, and, until compelled, would not pay anything. He then made inquiries at the Patent Office and found a patent anterior to Mr. Klug's, taken out by a gentleman of the name of Bremme. Few people would expect to find a patent valve motion amongst patent steering gears; but the agent looked at the word "Valves," and found in Mr. Bremme's specification a motion for closing the valve as the screw travelled along, precisely the same in action as this one. Well, this was rather serious; and, as they did not want to have any fight, they came to terms with Mr. Bremme and paid him £150 for the use of this gear, which ought, perhaps, strictly speaking, more properly to be called Bremme's motion. Its history was simply this: Mr. Bremme took out a patent, and one day within three months Mr. Klug took out a patent for the same thing. About six months afterwards Mr. Marshall took out a patent for the same movement. It was impossible he (Mr. Marshall) could have ascertained either the existence or the nature of either Mr. Bremme's or Mr. Klug's patents, for the provisional patent specification is not accessible during the time here involved. He had designed it innocently enough and adopted it, very much to his cost. Not many engines, so far as he was concerned, would be made with motion No. 2, Fig. 27, page 122; at the same time it had many

dvantages, alluded to by the writer of the paper. It gave great facility, without inconvenience, in working their valve motion and getting the valve chests in front of the engine; but the strains in working were so great that the advantages were more than counterbalanced by the risks attending its adoption.

Mr. E. Reynolds said that Mr. Marshall had very modestly given due credit to the Hackworths for their various improvements, but his own old firm of Messrs. R. & W. Hawthorn had always

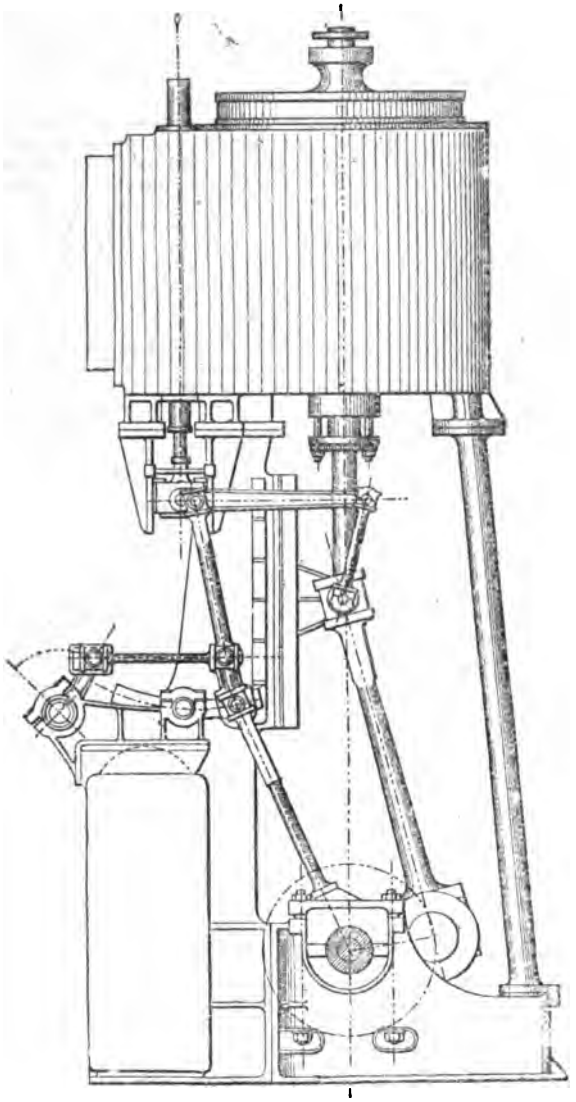


Fig. 36.

been distinguished by ingenuity in the invention of valve gearing. Many years ago they introduced a substitute for the link motion, in which a swinging link was substituted for the usual curved slot, this being the first example of a swinging link within his knowledge. Every one who had travelled in Belgium must be perfectly familiar with Walschaert's motion which had been described.

The Vice-President having failed to get the discussion on Mr. Milton's paper continued, and supposing that some interested members might be absent on account of the inclement state of the weather, said he could scarcely ask Mr. Milton to reply, as he had got nothing to reply to. In his opinion, the subject was far too interesting to engineers to be put to one side by such a very brief discussion, and he scarcely thought it was fair to Mr. Milton and his elaborate paper to allow it to lapse.

Mr. G. W. Sivewright said that two gentlemen from Hartlepool were to have been present to discuss the valve motion, but possibly the stormy weather might have kept them away. He was ready to propose that the discussion should be adjourned.

Mr. R. Thompson seconded the motion that the discussion be adjourned till next meeting.

The Vice-President, having put it to the meeting, declared the discussion adjourned. He took this opportunity of stating that within his recollection, and it must also be within their knowledge, ever since the introduction of the Hackworth motion, which was, if not the first, at any rate a very important attempt to deal scientifically with the action of the valve, it had been to a large

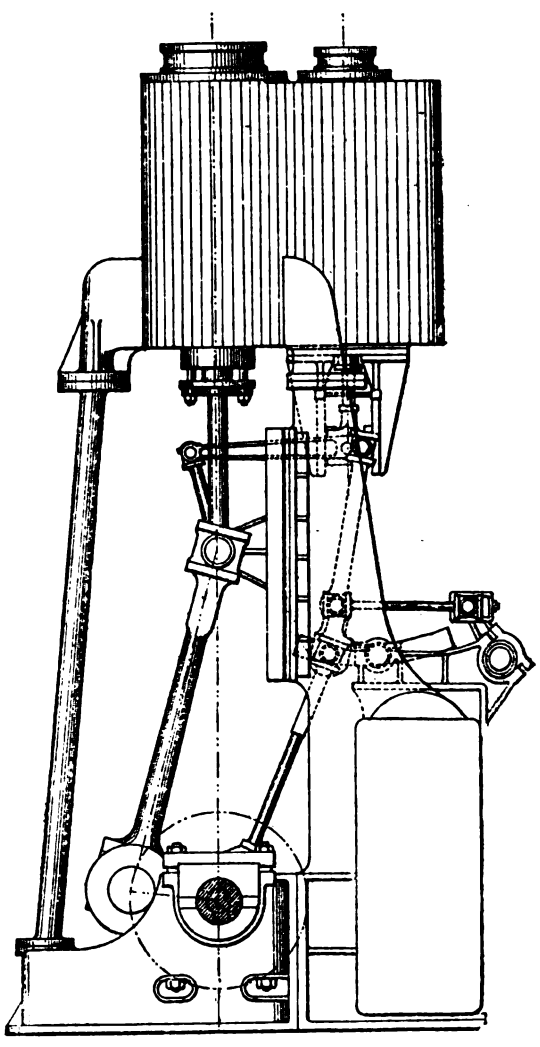


Fig. 37.

extent the foundation upon which all other important successful actions had been founded. They had heard what had fallen from Mr. Marshall, and they could not but admire the frank acknowledgment which a man of his ability and experience had borne to Mr. Hackworth's meritorious inventions. He thought they owed a debt of gratitude to that ingenious engineer, John Wesley Hackworth, and that they ought to make that acknowledgment fully and frankly. Very few of the men who had meddled with this subsidiary question had received due acknowledgment; but even at this late period of the day he felt sure he would be expressing their views when he said that they acknowledged in a frank and unquestioning manner the very meritorious contribution to the steam-engine by Mr. Hackworth's gear.

The adjourned discussion on Mr. J. T. Milton's paper on "Slide Valve Gears."

Mr. D. B. Morison said that had he been able to be present at the last meeting it was his intention to refer to the paragraph in

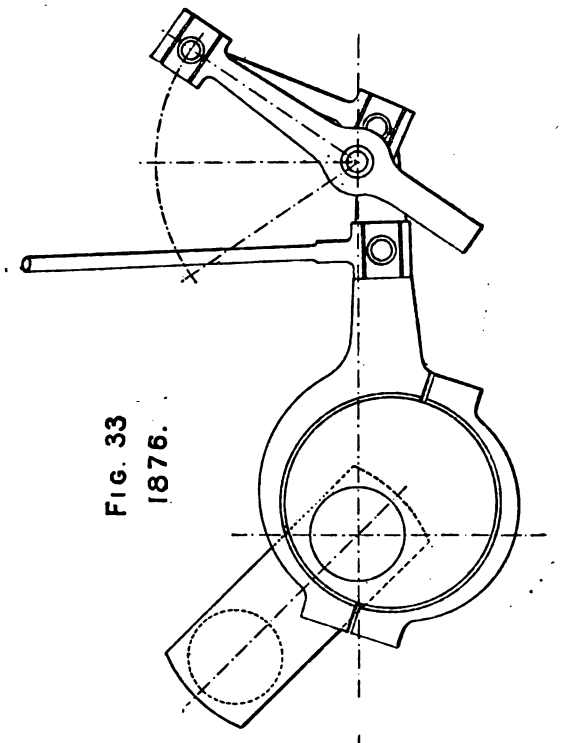


FIG. 33
1876.

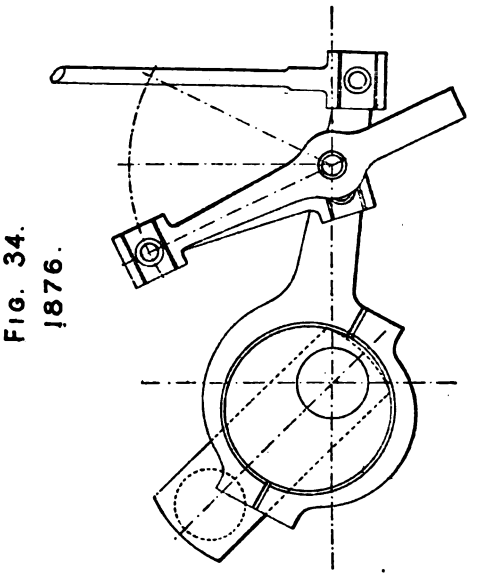


FIG. 34.
1876.

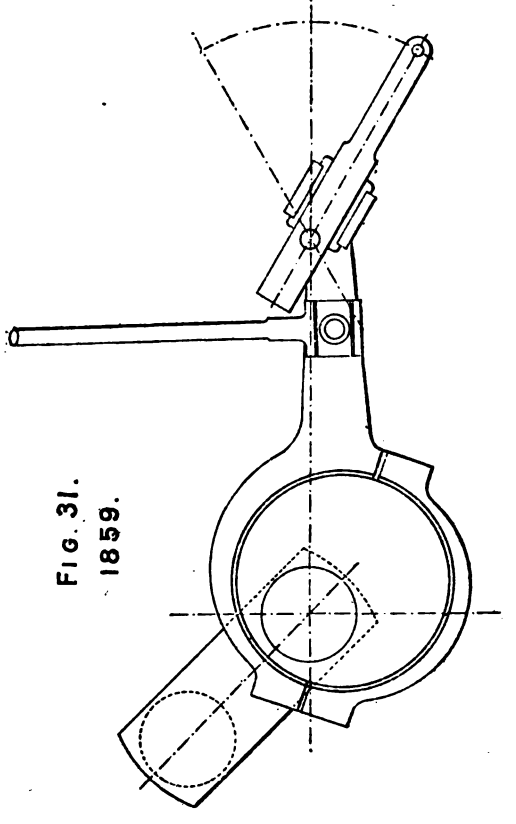


FIG. 31.
1859.

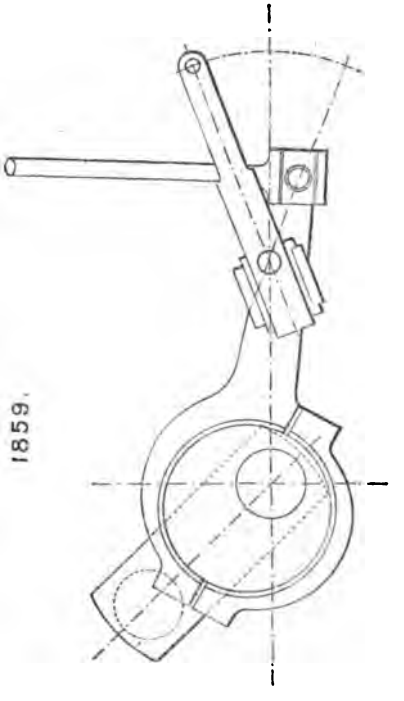
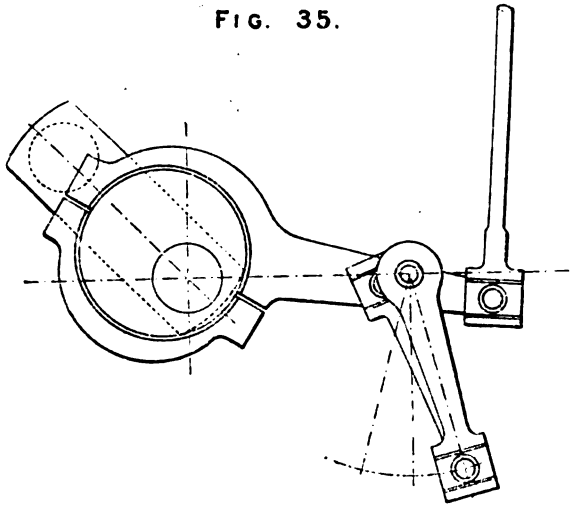


FIG. 32.
1859.

Mr. Milton's paper in which he sa'd the swinging link valve gear, described by the late Mr. Wyllie before the I.M.E., was identical with one form of Mr. Marshall's. Mr. Marshall opened the discussion by explaining that the gears to which his name was often attached were not his at all, although, at the time of patenting them, he thought he was the first inventor. Mr. Milton was evidently not aware of the extent of Hackworth's inventions, or he would have given him a little more credit than he had done; and Mr. Marshall also, in his (Mr. Morison's) opinion, was not exactly right in saying that what he termed his "unfortunate" gear should properly be called Bremme's gear. If Mr. Milton had examined the published reports and illustrations of Hackworth's gears, he would have found that, as far back as 1859, Mr. Hackworth was thoroughly conversant with the gear he described as Marshall's. In fact, Figs 31 and 33 are reproductions of illustrations published in that year. In 1876, Hackworth described and illustrated a gear, as shown in Fig. 32, which Mr. Milton had referred to as the second form of Hackworth's gear. It would be seen that the only distinctive and novel feature in this gear was the altered position of the fulcrum from beyond the valve spindle attachment to a point between that and the eccentric, consequently all the arrangements of gears invented by Mr. Hackworth in 1859 might be modified in this manner. For instance, Fig. 34 was an evident modification of Fig. 33; and Figs. 31, 32, 33, and 34 represented valve gears as invented by Hackworth prior to 1876. The late Mr. Wyllie fully appreciated the value and extent of Mr. Hackworth's inventions, and only considered the gears described by him in his paper as modifications, containing some elements of novelty as regards arrangement and proportion. The gears 31 and 33 are of course in a much better condition as regarded stresses than 32 and 34, but the amounts in each case could be very nearly approximated; and as the various parts of a valve gear were designed for the loads they had to bear, he could not see why the fact of a valve seizing, as mentioned by Mr. Marshall, would cause any more damage in the one case than in the other, although, of course, he granted that the form 31 and 33 would allow of much lighter gear and smaller surfaces. In 1879, a Mr. Bremme illustrated a gear, Fig. 35, in connection with a

FIG. 35.



steering engine, and had since published an advertisement pamphlet of several other forms, some of which might be found in the new edition of Seaton's Manual. Since, however, he seemed to insist that Hackworth had no right whatever to modifications, it was strange he did not adhere strictly to his own illustration, Fig. 35, where the reversing lever was placed on the opposite side from the valve spindle.

Mr. MILTON, in reply to the debate, said there had been so little discussion on the paper that he did not see any point raised to which one could make reply, except Mr. Morison's remarks. He had apparently misunderstood the subject of the paper, which was not to go into any question of the priority of patents. He (Mr. Milton) was not a patent agent nor a patent expert. In mentioning Marshall's gear and Kirk's gear, &c., he had given the names under which the gears were generally known and referred to. He had seen many engines, but he must say he never saw an engine fitted with gear known as Bremme's gear, and only one engine fitted with gear called Hackworth's gear, made by Mr. Morison's firm many years ago. When Mr. Wyllie described these gears he did not call them "Hackworth's," but "swinging link gear." One remark Mr. Morison made about valve gear was with reference to the strain upon them. Any disadvantage in regard to strength could generally be remedied by putting in sufficient weight, and, if it were a case of wear and tear, by putting in sufficient surface. But some kinds of surfaces were found not to wear as well as others. Sliding block gears would generally be superseded by swinging link gears, for sliding surfaces could not be kept true unless they had an excessive amount of surface. In all kinds of machinery with which he was acquainted, if it were possible to supersede sliding surfaces by rotating surfaces, it was done. The only part in a marine engine where the sliding block was retained was the piston-rod cross head, where guides had superseded the old-fashioned style of parallel motion. If they considered the surface necessary in a piston-rod cross head, compared with the load upon it, and contrasted them with the surface and load upon the crank pin, they would see the great advantage in using the circular motion instead of the sliding motion. Mr. Weir mentioned a gear as having been applied in certain cases, but practically it was the same as one form of Mr. Bryce Douglas's gear. The valve took its motion from a swinging lever in the same way, one end being worked direct from the piston rod, the other from the eccentric at right angles to it. The main object of the paper, which appears not to have been noticed in the discussion, is to show the small amount of difference in the motion produced by the different gears, so that the advantage or disadvantage of any special gear will depend mainly upon its simplicity, freedom from excessive wear, and ease and certainty of its accurate adjustment.

The PRESIDENT said he was sorry that Mr. Milton's paper had not caused longer discussions, but he was sure they would all accord Mr. Milton a hearty vote of thanks for the very able and interesting paper he had read before them.

The vote of thanks was agreed to.

ELECTRIC LIGHTING IN SCOTLAND.

MR. RANKIN KENNEDY, of Woodside Electric Works, Glasgow, has recently completed installations of electric light on the following steamers:—The *Smith* and *Cass*, two passenger ships built by Messrs. R. W. Hawthorn, Leslie & Co., Limited, for the Formosa Trading Company, China; the s.s. *Tynesider*, owned by the Tyne Steam Shipping Company, and trading between Newcastle and London; the *Paula* and *Caucase*, two oil-carrying steamers, built by Messrs. Sir W. G. Armstrong, Mitchell & Co., Limited, Walker Shipyard; the *Trieste C*, a small passenger steamer for the Adriatic, built by Messrs. William Simons & Co., Renfrew; and the *Leon y Castillo* and *Vera y Glavajo*, two steamers built by Messrs. D. J. Dunlop & Co., Port Glasgow, for the Canary Islands passenger and goods trade.

In addition to the above, the firm have now on hand three steamers, the *City of Oxford*, *City of Cambridge*, and *City of Calcutta*, for the "City" Line, of Messrs. George Smith & Sons, Glasgow; two large oil-carrying steamers for Messrs. Sir W. G. Armstrong, Mitchell & Co., Limited; and a number of other shipping and land installations of considerable importance.

Mr. Kennedy has now completed and is using exclusively for ship-lighting his double cylinder single-acting engine. It is being very favourably received, and is giving universal satisfaction. Where direct driving is desirable it is specially applicable. We hope shortly to publish a full description and results of tests of this engine.

The manufacture of a new incandescent lamp of large c.p. has been commenced at Woodside Electric Works.

THE OXUS FLEET.—The new Russian steamer, the *Czar*, made its first voyage on the Oxus on the 5th of June, leaving Charjui on that day for Kerki, 144 English miles above that place. If the experience of this journey up a river, the channel of which is liable to frequent and capricious changes, is deemed satisfactory, a regular service of steamers for passengers and merchandise is to be established, both above Charjui and below it, to as far as Petro-Alexandrovsk, in Russian Khiva. While the *Czar* is to ply above Charjui, its sister vessel, the *Czaritza*, is to perform the service below that place.

COPPER STEAM PIPES FOR MODERN HIGH-PRESSURE ENGINES.*

By W. PARKER, Esq., Chief Engineer Surveyor Lloyd's Register of British and Foreign Shipping, Member of Council.

AS might have been expected, the disastrous explosion of the main steam pipe and consequent loss of life that occurred on board the Royal Mail steamer *Elbe* in September last, and a similar explosion on board the North German Lloyd's mail steamer *Lahn*, have led to investigations as to the cause of these accidents; and, further, the whole subject of the manufacture of copper steam pipes has been considered generally, and experiments carried out with the view of ascertaining the behaviour of the different kinds of commercial copper under various conditions of treatment and at various temperatures. A summary of the investigations and the results of the experiments will not, I think, be without interest to these meetings.

The s.s. *Elbe* was built in 1870 by Messrs. J. Elder & Co., and fitted with ordinary compound engines. In February of last year she was placed in the hands of Messrs. Oswald Mordaunt and Co., of Southampton, for the purpose of being fitted with new boilers to work at a pressure of 150 lbs. per square inch, and of having her compound engines converted into triple expansive ones. This work was completed, and the vessel was running her official trial in Stokes Bay, when the main steam pipe abreast of the after boilers burst, and all in the stokehole at the time, numbering eleven persons, were killed by the sudden outrush of steam.

The s.s. *Lahn* is a new vessel built by the Fairfield Shipbuilding and Engineering Company last year. In March last, while on her second voyage across the Atlantic, her steam pipe burst in a somewhat similar manner, but the loss of life was less in this instance than in the case of the *Elbe*.

It was natural to suppose that the bursting of copper steam pipes, such as those of the *Elbe* and the *Lahn*, would be found to be attributable to defective workmanship or material, and that due care had not been exercised in the manufacture of the pipes; but these investigations go to show that elements of very serious danger enter into the ordinary methods of making brazed copper pipes, especially when intended for high-pressure steam.

The steam pipe which exploded on board the *Elbe* was 9⅜ in. diameter inside, and 6 ft. 6 in. long, the thickness of the copper was ·276 of an inch corresponding to No. 2 Imperial wire gauze; it was brazed in the usual manner, with a lapped joint, and to all appearance seemed a well-made pipe. The copper had been obtained from a first-class manufacturer in Birmingham, and analysis has shown it to be chemically of the best quality.

The pipe itself had been tested by hydraulic pressure on two occasions, once for the satisfaction of the builders to a pressure of 300 lbs. per square inch, and a second time by the owner's representative to 350 lbs. per square inch. These tests had been sustained in a perfectly satisfactory manner, and so far as could be judged, every care had been exercised by the makers to produce as good a piece of workmanship as possible.

Test pieces were cut from the exploded pipe and the copper away from the locality of the brazing was found to have an ultimate tenacity of 33,000 lbs. per square inch, with an elongation before fracture of 33 per cent. in a length of 5 in., so that the bursting pressure for this pipe in its cold state, should have been about 1,940 lbs. per square inch, being thirteen times the working pressure, or, taking the actual thickness of the copper at the fracture as measured after the explosion, and which was found to be $\frac{1}{32}$th of an inch, the pipe should still have borne an ultimate pressure of 1,220 lbs. per square inch, or 8·8 times the working pressure.

In order to ascertain the actual strength of the portions of the pipe adjacent to the exploded part, a piece of the pipe, about 30 in. long, was cut from the portion still intact of the length which exploded, and two other similar pieces were prepared from the next adjoining length of pipe. These short pieces were fitted with flanges and tested to destruction by hydraulic pressure, and in each case the pipe burst in exactly the same way, namely, through the copper near and parallel to the brazed seam, commencing near to one of the flanges.

The pieces taken from the same length where the explosion had occurred gave way under a hydraulic pressure of 780 lbs. per square inch, the fracture exhibiting a granular and in part a discoloured appearance.

Of the two pieces cut from the next adjoining length of pipe, one burst at 600 lbs. per square inch with the same granular and partly discoloured fracture, as if the metal had been injured or partially cracked through during the operation of brazing; and the other burst at 1,140 lbs. per square inch, the fracture being granular but not discoloured.

This great diversity in the bursting pressures for pipes of the same dimensions and material, and the similarity in the character and position of the fracture in each case, together with the fact that the pressure at which the strongest of these lengths burst was still not more than five-eighths of the calculated bursting pressure, seemed clearly to indicate that the material had been injured in the neighbourhood of the seam by the operation of brazing.

Some very careful experiments to ascertain the effect of increased temperatures upon sheet copper were made by the Franklin Institute in America as long ago as 1837, when strips of copper were pulled asunder in a properly designed machine at temperatures ranging from 122 degrees to 1,332 degrees Fahr., and, as will be seen by the following table, the falling off in strength as the temperatures increased was very considerable, until at 1,332° F., or a bright red heat, the tenacity was nil.

Experiments made at the Franklin Institute, America, in connection with an Investigation into the Strength of Boilers.

Temperature above 32°.	Diminution of Strength.	Temperature above 32°.	Diminution of Strength.
90°	0·0175	660°	0·3435
180°	0·0540	769°	0·4389
270°	0·0926	812°	0·4944
360°	0·1513	880°	0 5581
450°	0·2046	984°	0·6691
460°	0·2133	1,000°	0·6741
513°	0·2446	1,200°	0·8861
529°	0·2558	1,300°	1·0000

These results were substantially corroborated by a series of experiments made by Dr. Kirk and myself after the *Elbe* explosion.

From the Table it will be seen that at 360° F., or the temperature of steam of 150 lbs. pressure, copper has about 15 per cent. less tensile strength than when cold. But allowing for this falling off in tenacity, the steam pipe of the *Elbe* at 150 lbs. steam pressure should still have had a factor of safety of 8½.

Carefully examined through a microscope the difference in the structure of the copper in the neighbourhood of the brazing where the exploded pipe and those afterwards tested gave way, and the structure in that part of the pipe away from the brazing was very marked, and was clearly to be ascribed to the heating of the copper during brazing.

Test pieces were cut from the pipe near to the brazed seam where the rent had occurred, and it was found that whereas the copper from other parts of the pipe showed a tenacity of 33,000 lbs. per square in. with an elongation of 33 per cent. in 5 in. and 59 per cent. contraction of area as recorded above, in these pieces the tenacity was only 24,418 lbs. per square in., the elongation only 4·6 per cent., and the contraction of area at the fracture only 13 per cent. This results was amply confirmed by testing other strips cut from the same locality; they each showed that the copper near the brazing had lost its ductile qualities and much of its tenacity.

In order to obtain further information on this point, the following experiments were made:—

1. A strip of good copper was cut from a sheet and bent and broken cold.

2. A similar piece was raised to a heat above that necessary for brazing, when it became red short, and broke with its own weight.

3. A piece was raised to the same bright heat as No. 2, allowed to cool, and then broken cold.

* Read at the Thirtieth Session of the Institution of Naval Architects July 25th, 1888; the Right Hon. the Earl of Ravensworth in the chair.

4. A piece was raised to the above brittle heat, at which it was partially broken through, then allowed to cool, and the fracture completed when cold.

The appearances of these fractures were very interesting, as may be seen in the specimens on the table: the first had the fibrous silky appearance of a good copper; in the second piece the fracture was coarse and blackened by the heat; but the third specimen seemed to have almost completely regained its tenacity and ductility on cooling, the copper in its normal state having a tenacity of 35,212 lbs. per square in. with an elongation of 40 per cent. in 5 in., and a contraction of area at the fracture of 39·9 per cent.; and the third specimen, although it had been raised to a blistering heat, was, when cold, found to have a tenacity of 31,337 lbs. per square inch, with an elongation and contraction of area at fracture practically the same as the normal copper, which would appear to show that, although the copper should be over heated in brazing, if not otherwise injured, its qualities will be substantially regained on cooling.

The fourth piece was partially broken while hot, and the appearance of that part of the fracture was discoloured by the action of the heat, but the part that was allowed to cool had its ductility restored, and afterwards broke with a bright fracture. This experiment was repeated a number of times, with similar results, and the fractures corresponded *exactly* in appearances not only with that of the exploded pipe, but also with those of the *other pipes* which were experimented upon, and which burst at pressures of 600 and 780 lbs. per square inch respectively.

The only difference in these fractures was the depth to which the partial crack, as shown by discoloration, had extended.

In this manner the exact appearance of the fractures of the exploded pipe, and of those experimental pieces which burst at the low pressures, was *reproduced artificially* by burning the copper and treating it in the way described.

From this it will be seen that, should a copper pipe be overheated during the brazing operation, and seeing that the metal becomes perfectly brittle at not much above the brazing heat, the pipe might accidentally be cracked when in this brittle condition; and, although the section of metal still remaining intact might be sufficient to sustain the cold-water test pressure, yet the hot steam and accompanying strains might develop and deepen the crack, and the pipe ultimately give way at the working pressure.

This I consider to be the true explanation of the explosion of the *Elbe's* steampipe, and also that of the s.s. *Lahn*.

A serious element of danger is thus shown to exist in the present practice of brazing large, heavy copper pipes intended to be subjected to the high pressure now so common. It is generally admitted that welds or brazed joints in any material must possess certain elements of uncertainty, and the above experiments show this uncertainty to be greatly increased in the case of copper worked over a fire.

How to eliminate these elements of danger becomes an important question. Various alternatives suggested themselves, as, for instance, that the copper might be worked cold and the joint made by a riveted seam, that brazed pipes might be served with wire or have strengthening bands fitted at short intervals (both of which systems I find are now resorted to), or that steel pipes might be used, the seam being riveted.

While these points were under consideration, I had brought to my notice by Mr. W. Elmore a method of making copper pipes of any required diameter, length, or thickness by electro deposition, and I was instructed by the Committee of Lloyd's Register to proceed to Mr. Elmore's works and witness the operation of making these pipes, with a view to reporting thereon for the information of the Committee. The process is briefly as follows:—A mandril is surrounded by ordinary unrefined Chili bars arranged upon strong supporting frames in a depositing tank of sulphate of copper, and the copper is dissolved or decomposed, as will hereafter be explained, and is deposited in the form of pure copper on the revolving mandril, leaving the copper in the form of a shell or pipe, of any thickness required, fitting closely to the mandril. When the required thickness has been deposited, the pipe and mandril are exposed to the action of hot air or steam, then the copper expanding more than the iron admits of the mandril being drawn, leaving the copper in the form of a pipe, without a seam, perfectly round and true both internally and externally; or the pipe may be expanded or made larger by rolling or other mechanical means, and then the mandril withdrawn.

The deposition of copper by electricity is not at all new. It has been in use for years for electrotyping purposes, and for separating copper from its impurities, and particularly for extracting gold and silver. But copper thus refined is wanting in cohesive properties, and without some means of increasing its density, which would give to it, at the same time, both tenacity and ductility, it would in such a form be useless for mechanical purposes, and the ingenious manner in which this difficulty is overcome by the present process constitutes its most important feature.

A burnisher or planisher, composed of a small square piece of agate, being the hardest and smoothest substance suitable and available, is supported upon proper arms and levers, and the agate is allowed to press lightly upon the surface of the copper on the revolving mandril. The burnisher is caused to traverse from end to end of the mandril by means of a leading screw at any required speed. After it has traversed the whole length of the mandril, it is automatically reversed, and commences its journey backwards. The speed of the revolving mandril and the speed of the traversing burnisher is so adjusted or arranged that the whole surface of the copper is acted upon by the burnisher, the result being that every thin film of copper deposited upon the mandril must be separately acted upon, burnished and compressed into a dense and cohesive sheet of pure copper possessing a great amount of tenacity and ductility, as will be seen from the results of the experiments and tests which I have made, and which will be referred to further on. The impurities or dross fall to the bottom of the tank in the form of mud, and when washed, dried and smelted in a crucible, the gold, silver, &c., contained therein can be easily separated. In fact, during the operation of refining copper from the rough Chili bars, the finished article is automatically produced in the form of a pipe, and all the impurities are extracted and can be collected.

While I was present at the works of Mr. Elmore, the patentee of this process, four pipes were made. The mandrils had been revolving in the baths for about 170 hours, and the copper in this length of time had reached a thickness of ·198 in. The pipes were taken off the mandrils in my presence, and the ends of the pipes cut off, so as to present a portion of the pipes acted upon by the burnisher. The remaining portion, or rough ends, shows the nodules, or rough copper, not acted upon by the burnisher, which is in a completely brittle condition. This will be seen by the specimen.

(To be continued.)

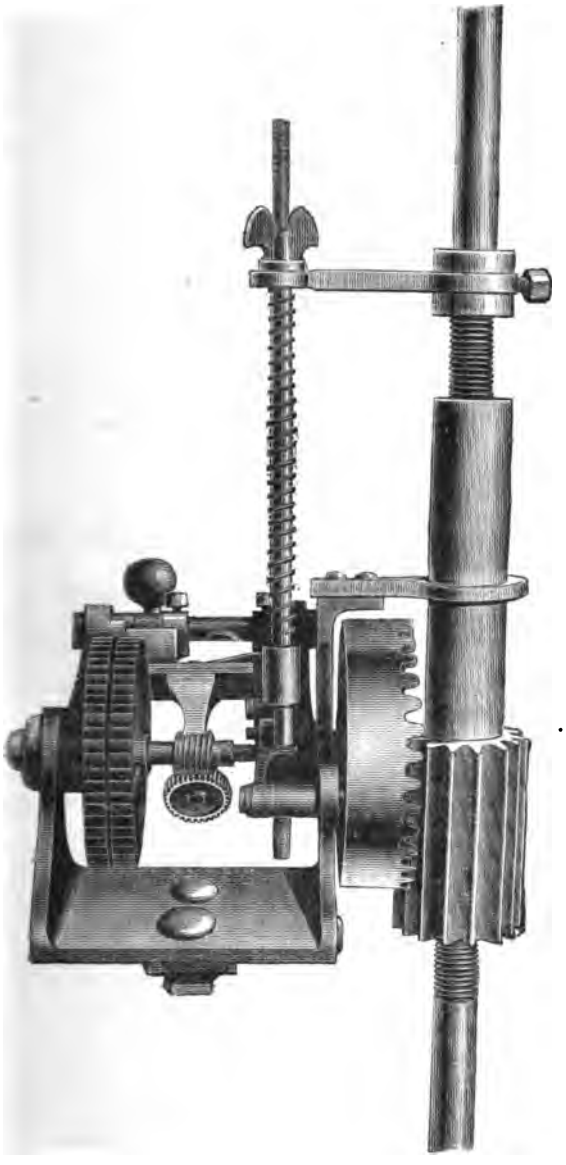
MR. SAMUEL SMILLIE'S EXHIBITS AT THE GLASGOW EXHIBITION.

MR. SAMUEL SMILLIE, 71, Lancefield Street, Glasgow, has on view a radiator for heating ships' cabins, feed-water heaters, an evaporator fitted with automatic water feed, for producing fresh water for marine boilers; and a patent condenser for producing pure aerated fresh water from salt water, and which is likewise intended for ships' use. This apparatus is one of the most substantial and effective appliances of the kind which we have ever seen. Its utility for the purpose aimed at is at once transparent when we state that it is of simple construction, and can be easily taken to pieces and put together again by an ordinary workman, *i.e.* when requiring cleaning. The tubes are made of solid drawn brass, and tinned both sides throughout, while all the other internal parts are made of gun metal and carefully tinned. The water produced by this useful machine is thoroughly pure, palatable, and is ready for immediate use. Being complete in design, and constructed under the patentee's personal supervision, each of these condensers can always be relied upon. The condenser—which has been approved and sanctioned by the Board of Trade, is peculiarly well adapted for troop, emigrant, and cattle ships, and is capable of condensing any quantity of water, either with or without filters.

Mr. Smillie is also the maker of similar appliances for yacht use. They are constructed entirely of brass, possess an attractive appearance; and that they are exceedingly useful is found in the fact that vessels fitted with them can with safety take lengthened cruises independent of any other water supply.

WILBY'S PATENT SPEED REGULATOR.

THE accompanying illustration shows a very ingenious piece of mechanism, patented by Mr. R. Wilby, for controlling an engine fitted with any ordinary type of governor so as to ensure its maintaining, when once set, a uniform rate of speed. The maker, Mr. James Lumb, of the Perseverance Works, Elland, Yorkshire, has kindly supplied us with the following particulars, and has also brought under our notice a large number of testimonials, all of which testify to the very satisfactory results obtained from engines fitted with the speed-regulator.



As will be seen from the illustration, the regulator has but few moving parts, and consequently the liability to derangement is very small indeed, while the power absorbed to actuate it is so slight that it may be totally ignored.

Briefly, we may state the action to be as follows :—The vertical rod, on the right of the figure, is the ordinary expansion or throttle-valve rod, and this is provided with a deep sleeve-like right and left handed screw-threaded regulating nut, carrying a deep pinion wheel which engages with the crown wheel. The crown wheel is secured on the small horizontal shaft, on the other end of which are also secured two ratchet wheels, the teeth of which are cut in opposite directions. To these ratchet wheels motion is imparted by two pawls, so fitted as to impart either right or left handed motion to the crown wheel (and so shorten or lengthen the expansion or throttle-valve rod), according as one or the other pawl is put in gear with its respective ratchet wheel. The pawls are placed on an oscillating frame, the free end of which is attached by a cord, or otherwise, to any convenient reciprocating part of the engine.

To set the regulator so as to maintain any desired rate of speed, the collar, provided with a set screw, is clamped on the rod, so that its projecting arm or bracket will just allow the small vertical spindle, on which is placed a spiral spring, to depress one of a system of levers (not very clearly shown in the figure) to such an extent as will cause them to bring into action a pawl-reliever. This pawl-reliever serves, when the engine is running at the desired speed, to keep both pawls from engaging with the ratchet wheels ; but should the speed increase or decrease, then the governors would cause the valve rod to lower or lift, and thus depressing or releasing the system of levers would bring into play one or other of the pawls, so causing the crown wheel to move, and thus shortening or lengthening the expansion or throttle-valve rod. The regulator is also fitted with a very ingenious device to prevent overwinding or locking up of the rod, but we regret that our illustration does not render this sufficiently clear to enable us to more fully describe it.

From the foregoing description it will be seen that the work of turning the regulating nut, and so altering either the expansion gear or throttle valve, is, in engines provived with this regulator, performed by the engines themselves, and not by the governor—a point of great importance, and undoubtedly a decided advantage in the manipulation of large engines.

From speed-diagrams taken by a Moscop's recorder, we can testify to the great regularity of turning achieved by engines fitted with the regulator.

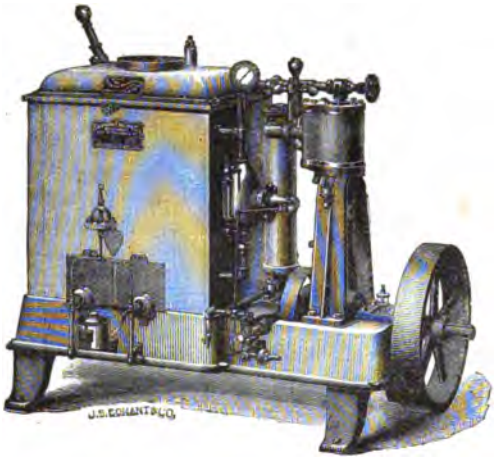
MESSRS. MUNGO GRAY & CO.'S EXHIBITS AT THE GLASGOW EXHIBITION.

THE firm of Messrs. Mungo Gray & Co., whose premises are situated at 104, Hope Street, Glasgow, are represented by a number of miniature masts and sails, and by Mr. James Spencer's patent self-acting ships' scrubber for cleaning the bottoms of ships at sea. This scrubber was patented only some two years ago, and in the interval the makers have supplied many of the leading shipping firms with large numbers. The scrubber possesses the advantages of efficiency, simplicity, and economy, and is deserving of a still wider sale.

NEW AMERICAN CRUISER.—The new American naval cruiser *Charleston* was launched at San Francisco on July 19th. She was planned by Messrs. Armstrong, and is a duplicate of their Japanese cruiser *Nanwa*, of 3,750 tons displacement, and carries eight heavy guns. This is the first naval ship built on the Pacific coast.

MESSRS. JOHN DONALD & SON'S EXHIBITS AT THE GLASGOW EXHIBITION.

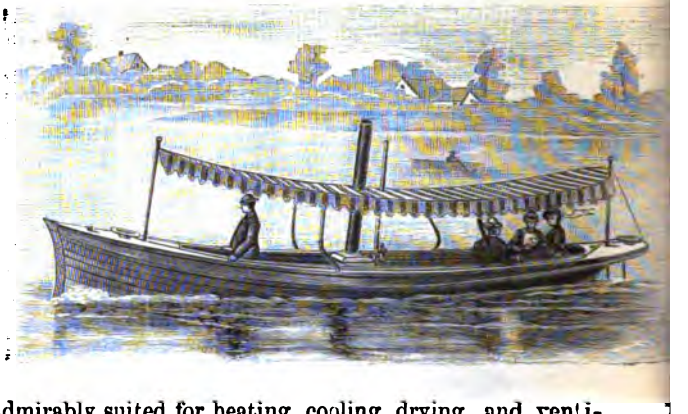
AMONGST the most prominent exhibitors at the Glasgow International Exhibition are the Messrs. John Donald and Son, 42, Cadogan Street, Glasgow. This firm have two separate exhibits, both of which are located within the machinery department. Perhaps the most notable article shown by this old-established firm is the "Shipman" engine, which is on view at their stall, 376, and which we here illustrate. Perhaps the leading feature in connection therewith is that the fuel used is petroleum, which is burned under a tubular boiler, and the steam emanating therefrom supplies an ordinary steam engine. The "Shipman" engine, we may here explain, burns petroleum in the boiler, instead of coal, and is perfectly automatic in regard to the supply of both fuel and water. Only the best materials and highest class of workmanship are employed in its construction, and these, together with the adjustments for wear and appliances for safety, are similar to, and upon a level with, those of the most costly engines anywhere built. It is interesting to note the way in which the fuel is applied. In the first place, the



petroleum is propelled by means of a steam jet through a pair of "atomizers," in the form of a fine spray, into the furnace. It is there ignited, generating a very hot flame, which spreads among the boiler tubes. The combustion is so perfect that no smoke or smell is produced. Fire is first formed by pumping air into the boiler and making use of the pressure so obtained to produce the petroleum spray. After a few minutes' pumping, steam is formed, and the use of the air-pump discontinued. A distinctive feature in this machine is that, virtually speaking, no skilled attention is required in the working of same. This is due to two reasons. In the first place there is automatic control of the fire. This is obtained by means of a device called the "diaphragm," which, closing at any desired pressure, cuts off the supply of steam to the "atomizers," and thus reduces, or entirely stops, the supply of liquid fuel. The "diaphragm" is so sensitive that the slightest change in the "load" of the engine makes an instantaneous difference in the fire. If every belt in a shop were suddenly thrown off, the steam would not rise five pounds in pressure, so quickly are the fires checked, and then extinguished, by its action. The second reason is because the water supply is automatically controlled. The feed-pump continues in operation as long as the engine is in motion, but the amount of water it delivers to the boiler is determined by a ball-float, which, by opening and closing the suction, keeps a uniform water-level in the boiler. So long, therefore, as oil is supplied to the "atomizers," and water to the pump, the "Shipman" engine takes care of itself, and, as already stated, requires no skilled attention.

Another interesting structure shown by this firm is the "Shipman" steam launch, which, by the way, has already been successfully experimented upon in the river Kelvin, within the Exhibition grounds. The distinctive features of this exhibit are, that it ensures automatic control of the fire and feed pump; no coal is required, and consequently no stoking is necessary; and besides there is no smoke or dust. We may further state that the motive power for this launch is obtained from a two horse-power "Shipman" automatic steam engine, with paraffin oil for fuel instead of coal. The utility of the launch for many useful purposes is pretty clearly indicated in the illustration here given.

In addition to the foregoing, the Messrs. Donald and Son exhibit a large number of articles, some of which are in daily use in several parts of the kingdom. Among these we note the Aland's patent air propeller, which is

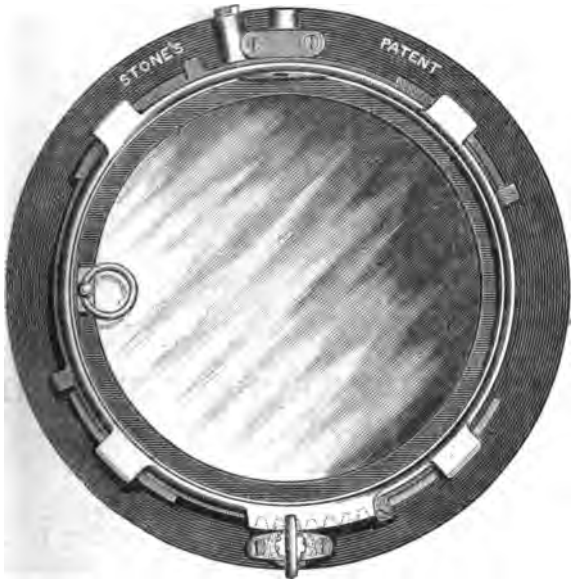


admirably suited for heating, cooling, drying, and ventilating purposes. Also the Aland's fan blowers and exhausters, which are excellently suited for smiths' fires and cupolas, for exhausting foul air, dust, &c.

The Messrs. Donald and Son likewise exhibit a collection of exceedingly well finished engineers' and blacksmiths' tools, besides a specimen of the "Unbreakable" wrought-iron pulley, which is only half the weight of cast iron, and which may be used with or without interchangeable bushes. The "Hancock" inspirator, a reliable boiler-feeder and water-lifter, is also included in the varied collection by which the Messrs. Donald and Son are represented. Space forbids us commenting on these further, though we cannot help remarking that the articles shown at the stalls occupied by the above firm are amongst the most representative collections—*i.e.*, coming under the category shown within the Exhibition. The superior quality of the material used, the excellency of the workmanship, and the suitability of the articles exhibited for the purposes for which they have been constructed, are amongst the distinctive qualities daily admired by the practical mechanician and other visitors capable of forming a rational judgment on products of this character.

"PIVOTED" SIDE SCUTTLE.

MESSRS. J. STONE & CO., Deptford, who have in the past introduced many excellent appliances conducive to the health and happiness of those who go down to the sea in ships, have quite recently improved upon their patent "Pivoted" Side Scuttle for deck houses, &c. The scuttle is manufactured with four or more wedge fastenings, simultaneously operated by a single handle. Although suited to the requirements of most ships, they are more specially adapted for first-class vessels trading in or to and from hot climates, where a plentiful supply of fresh air is a *desideratum*. By setting the scuttle to look forward it will cause a current of fresh air to blow directly into the cabin; by setting it to look aft the vitiated air will be drawn out by the partial vacuum caused by the current of outside air striking against the projecting surface of scuttle. This position will also prevent spray entering into the cabin, and, in the case of rough weather, a heavy wave will close it.



The scuttle can be opened, closed, and fastened with the greatest ease; and the amount of opening required can be automatically regulated to any desired extent. It is practically tight when simply closed, without being fastened at all. When opened, the glass door is not rigidly fixed, but will yield to pressure from the outside, and close. When fastened, it is kept perfectly watertight by the round indiarubber ring in frame being compressed and made to bear tightly all round against outer rim of the glass door. This is accomplished in a very simple manner, by having the compression ring operated by a single handle, which works a rack and pinion, and causes the ring to partly rotate and simultaneously enter into or recede from four or more equidistant wedge pieces on scuttle frame, thus giving equal pressure all round, and so ensuring a perfect joint. There is no risk of breakage of glasses, as in ordinary large scuttles, where one fastening is frequently injudiciously screwed down more than the others, for in the scuttle under notice the strain of fastenings does not bear upon the glass at all, so that much lighter glasses can be used if desired. Wind scoops are, therefore, dispensed with; in short, Messrs. J. Stone and Co. have thoroughly studied out every little detail

concerning their patent, which will doubtless add not only to the many comforts now to be found aboard ship, but to their reputation and their exchequer.

MR. RANKIN KENNEDY'S EXHIBITS AT THE GLASGOW INTERNATIONAL EXHIBITION.

IN a central part of the machinery department is located the stall of Mr. Rankin Kennedy, Woodside Electric Works, Glasgow. The exhibit comprises specimens of Kennedy's patent dynamos, complete generating plant for the electric lighting of ships, alternating-current generators and transformers. One of the most notable features in this exhibit is the variety of Kennedy's patent lamp-shades, which include arc and incandescent lamps.

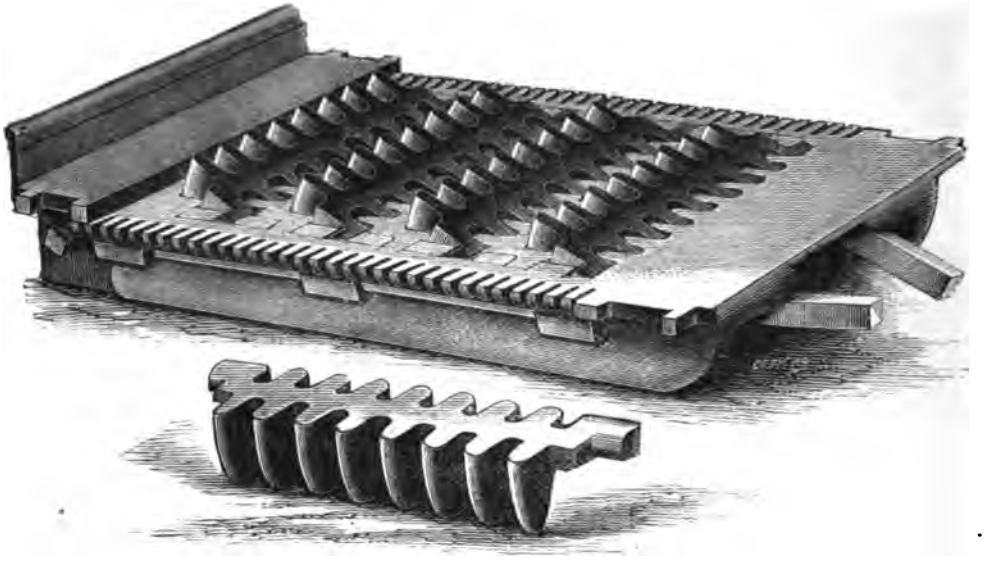
The new type of dynamo known as Kennedy's compound-wound, self-regulating, slow-speed dynamo is deserving of special notice. The field magnet of this machine—which is manufactured at the Woodside Electric Works—consists of three pieces with only one field bobbin. The core of the bobbin is made of the best hammered scrap-iron, is 10 inches in diameter and 14 inches in length, while the other two pieces are of soft cast iron, being of much greater cross section than the former named—an arrangement which has the advantage of simplicity of construction, combined with compactness and extremely low magnetic resistance. Further, it is a single horse-shoe machine, and it is pretty generally conceded that the single-magnetic systems are superior to the double-magnetic plan. We have only to add that the electrical efficiency of the machine has been satisfactorily demonstrated by eminent authorities.

THE GALATEA.—The *Galatea*, 12, screw armoured cruiser, built by Napier & Sons, Glasgow, is to be completed for sea at Portsmouth by the 30th of November.

SETTLE'S PATENT SMOKE PREVENTING ROCKING FURNACE BARS.

WE have recently received from Messrs W. J. Fraser and Co., steam boiler makers, Commercial Road East, who are the sole manufacturers and licensees for marine boilers in England, particulars of these bars and of the very satisfactory progress now being made with them. As will be seen from the accompanying illustration no complicated fittings are required, and consequently both first cost and maintenance are brought to the lowest, while from their very form a greatly increased draught is insured, the shape of the bars tending themselves to a closer connection between the fire and the air than obtains with any other form of bar with which we are acquainted.

By this means a great reduction in smoke is effected, even when using small coals, and that without inlet of cold air either in the door or back of furnace. When worked occasionally by hand, or otherwise, the very decided motion of the bars prevents the formation of clinkers, and by riddling out, as it were, the fine ashes, keeps a constantly bright fire, so greatly reducing the labour of stoking and allowing of a quick and constant



production of steam. Further, this motion of the bars dispenses with the necessity for the use of the poker, slice, &c., a great advantage in the case of forced draught, where the constant opening of the furnace doors is attendant with many disadvantages.

Messrs. Fraser inform us that these bars have now been at work over twelve months at some of the heaviest fired furnaces in Lancashire ; that there are now nearly one hundred furnaces at work, some of them with the most inferior coal, and that in every case they are giving the utmost satisfaction. From a number of testimonials sent us we select one, from which it will be seen that the bars were subjected to working conditions very similar to what would obtain at sea. The writers state, "After using your fire bars day and night in our two boilers for three months, we are pleased to say they keep fires free from clinkers, and fully come up to our expectations."

From the above cursory description we think it will be readily seen that these bars possess many distinct advantages, and that they are eminently qualified to fulfil all the requirements of marine engineers.

A New Log.—Official trials of a new form of log have recently been made on board some of the French torpedo-boats. The log is made of bronze of cylindro-conical form, and weighs about 5·5 lb. It is provided with a hollow tube running down its centre, which is connected by a canvas-covered indiarubber tube to a pressure gauge on board. When the ship is under weigh, the flow of the water past the log establishes a partial vacuum in the tube, and causes the pointer of the pressure gauge to move over its dial, which is graduated to give the speed of the vessel from 4 up to 25 knots.

MESSRS. HARVIE & CO.'S EXHIBITS AT THE GLASGOW EXHIBITION.

ONE of the largest and most representative collections of ships' lamps within the main building is that shown by Messrs. Wm. Harvie & Co., lamp makers and electric lighting engineers, 222, Broomielaw, Glasgow. The firm are represented in several different parts of the Exhibition. At their stall, No. 207, are to be seen specimens of Harvie's patent ship signal lamps and lanterns, constructed on the dioptric system, as applied to lighthouses, consisting of port, starboard, and mast-head lanterns, river and harbour lights, patent 'tween deck, engine-room, and other types of lamps ; also selections of saloon pendants, brackets, roof-lights, and engine-room and ships' signal lamps for electric light. The essential feature of these signal lamps is their internal construction, whereby a chimney draught is obtained without the use of a glass chimney, so that a clear and smokeless flame is secured.

At another stand occupied by the Messrs. Harvie and Co. is exhibited a complete installation of electric lighting for steamships, consisting of a high-speed engine coupled direct to a slow dynamo, and which lights a selection of saloon pendants, brackets, roof-lights, search-lights, etc. The exhibitors' club-room is lighted by Messrs. Harvie's electric lamps, the remarkable illuminating power of which forms a theme of repeated expressions of admiration.

ANTI-CORROSIVE PROPELLER BLADES.

THE subject of corroding or "pitting" of cast-steel propeller blades has long engaged the attention of marine engineers and shipbuilders, and seems now, thanks to the invention of Mr. Willis, of the firm of Messrs. John Willis & Co.'s "Speciality" Steel Works, Attercliffe, to be in a fair way of being set at rest.

Before noting Mr. Willis's invention we may, as showing the importance of the subject, be pardoned for briefly noticing an important paper read by Mr. W. C. Wallace at the last session of the Institution of Naval Architects, and in which he placed before his hearers data as to the cost, durability, and strength of the materials which are now used, or are suitable to be used, for the construction of propellers. His conclusions as to costs per ton were :— cast-iron, £24 ; steel, £38 ; gun-metal, £130; manganese bronze, £135 ; phosphor-bronze, £170 ; delta-metal, £115 ; aluminium-bronze, £145. In the discussion following the paper, Admiral Colomb stated that he had been horrified at the amount of corrosion and pitting in cast-steel propeller blades that had taken place in a very short time, and asked for information how it was that this pitting always took place at the back part of the blade. Mr. J. F. Hall expressed the opinion that the corrosion was occasioned by the sucking tendency caused by the blades always working in the same direction, and thus in time drawing out of the steel the particles or molecules which had not sufficient affinity in themselves to hold together as corrosion went on. Others took part in the discussion, including Lord Ravensworth, the chairman, and at the time it excited great interest in Sheffield, many manufacturers setting themselves to study and experiment, and as a result of all this Mr. Willis devised his new method of preserving iron and steel propeller blades from corrosion.

Recognising at the outset that the first cost of manganese-bronze or other similar metals for blades weighs seriously with shipowners, Mr. Willis determined upon confining his attention to the cheaper and better-known metals, iron and steel, and his invention consists in supplying a coating of copper united to the casting.

This is effected by the copper plate, properly bent to shape, being placed in and forming part of the mould into which the iron or steel is poured, with the result that the copper is firmly united by fusion to the iron or steel face of the blade. All anti-corrosive metals are covered by the patent, and several of these are now undergoing tests to ascertain which is most suitable for the purpose. From specimens we have seen there appears to be a perfect joint, the steel and copper being fused together and thoroughly united. We shall watch with interest for further particulars of this process, and trust later on to report the result after a blade so fitted has been long enough at work to warrant one in expressing an opinion as to its practical utility.

A STRAYED TORPEDO FOUND.—A torpedo that was lost in Stokes Bay from the *Polyphemus* five years ago was recently picked up by a fishing boat, the missile having been caught in the centre of the net. The outer case of the torpedo was considerably worn, and large holes had been eaten in it by rust, so that it was full of sand and shingle, and therefore practically valueless. The fishermen's nets were much torn in hauling the torpedo to the surface, and the Government have offered to make good the damage, in addition to paying a reward of £5.

WELLS' WHITE PITCH OR CAULKING GLUE.

WE have recently received from the manufacturer, Mr. William Wells, chemical manufacturer, Leith, a specimen of an unique preparation of white pitch. We may safely say that to ship, and perhaps more especially yacht, builders, the introduction of a material possessing all the desirable qualifications of ordinary pitch, with the additional advantages of its being of a clean white colour and odourless, will prove of great interest and utility.

It is well known that the only material hitherto available for forming white deck seams has been putty, a material possessing only very limited powers of cohesion, and utterly wanting in the properties of elasticity and strength, so essential in any caulking substance to enable it to retain its hold of the timbers during the expansion and contraction of the decks under atmospheric influences.

Finally, we may say that Mr. Wells's "White Pitch" is melted and run into the seams in the same way as ordinary pitch ; that it is strong, adhesive, odourless, and has a high melting point ; and that among other firms it is already on order by the following :— Messrs. J. & G. Thomson, Messrs. The Fairfield Shipbuilding Company, Messrs. Harland & Wolff, Messrs. Sir W. G. Armstrong, Mitchell & Co., &c.

NEW AMERICAN YACHT.

A YACHT, which is to be sent over to England next summer, to be matched against all comers of equal tonnage, has recently been designed by Capt. F. L. Norton, late of the United States Navy, and now of the Norton Shipbuilding Co., New Jersey City. The new vessel is to be an all-steel schooner, keel boat, 100 ft long, 26 ft. beam, and 12 ft. deep, with a greatest draught of 8 ft., and a depth of water ballast of 4 ft. She will be ballasted on what her designer calls the "live-water ballast system," and it is claimed that the vessel will be uncapsizable and unsinkable. Diagrams of a passenger steamer on this system are now being exhibited at the Life-saving Appliances Exhibition at the Alexandra Palace, Muswell Hill. Captain Norton is sending over a lifeboat to this Exhibition built on the same principle, and it is now crossing the Atlantic.

We may also here mention that at this same Exhibition is now being shown a lifeboat of novel design. The boat is a wooden one, intended for ship-work or use on the coast ; and the advantages claimed for it are, that the resistance offered by the water in rowing or sailing to the wind is considerably less than in other boats ; that it is practically impossible to upset it, because there is no centre of gravity excepting a theoretical one, and the consequence is, the righting lever and the metacentric height are abnormally great, unlike any other boat of a similar description. The boat does not require more than twelve inches of water to float it in, and the cost, built either in wood or steel, is below half the cost of an ordinary lifeboat. It may be interesting to note that while this boat took only six days three hours and forty-seven minutes to come from New York to Liverpool by the *Etruria*, it took three weeks and six days to get it from Liverpool to its destination (the Alexandra Palace) in London.

MESSRS. STEVEN AND STRUTHERS' EXHIBITS AT THE GLASGOW EXHIBITION.

THIS well-known firm of brass-founders, whose works are situated at 34, Elliot Street, Glasgow, exhibit a varied collection of articles, not a few of which are utilized for marine purposes. The collection includes Murdoch's patent governors for marine engines, a patent syren and signalling apparatus, as supplied to lighthouses, lightships, &c., reducing valves, rotary pumps, and improved patent self-contained visible-supply impermeators. The last named is rather an attractive article of its kind. It consists of a vessel for containing oil, on the top of which there is a glass tube filled with condensed water, through which the globules of oil are to be seen ascending. The oil, after leaving the glass tube, passes down through the impermeator to the steam-pipe or engine. A small condenser is fitted and connected by pipes to the central passage of the apparatus, and through the water-valve to the bottom of an oil-vessel, thus providing a supply of condensed water to replace the oil used through the impermeator. The whole is fitted on a stop-valve with screwed tail, for securing to steam-pipe or engine casing, as required. The contrivance is specially suitable for engines, such as paddle, small marine, launch, electric light, and steering engines, also for horizontal engines, or, indeed, wherever the steam-pipe is near to the platform. The peculiar qualities of this machine are, that it requires no pipe connections; simplicity in construction; easily worked; and not liable to sudden derangement.

We confess to having been favourably impressed with this impermeator, and we have much pleasure in recommending it for trial to those in quest of such appliances. The numerous other articles shown by the Messrs. Steven and Struthers are, one and all, characterised by excellency of workmanship, besides being of superior material; and, altogether, their stand makes one of the most complete shows in this part of the Exhibition.

MINNS'S "SCIENTIFIC" BOILER FLUID.

WE need not here dilate upon the many and great advantages of clean boilers; the facts are patent to every intelligent observer, and have been amply dealt with in our pages before; but we are always pleased to notice any method or means by which these advantages can be attained, and the latest step in this direction that has been brought under our notice is the above-named fluid.

This composition is prepared upon a new and scientific basis, and is entirely free from any chemicals that would act upon iron, steel, copper, gun-metal, &c., and therefore, in using it, no fear need be entertained of injuring the boiler or any of its mountings; in fact, the effect of the composition is to preserve rather than destroy the boiler and its fittings.

It will, we think, be generally asknowledged that there is no valid reason *why* a boiler should not be kept clear of scale and corrosion if only the proper method of treatment be adopted, and this proper method Messrs. Minns & Co. have undertaken in a scientific manner to demonstrate for, if need be, every particular boiler. In effect they say, "Aid us to discover the real cause of the evil, and we will undertake to supply a remedy." To enable them to do this, they get, wherever practicable, a sample of the water used; this is analysed, and a report upon it drawn up by a competent chemist, whose large experience in this class of work enables him to advise Messrs. Minns as to the necessary composition of the fluid to be used with the water in question. From this it will be seen that the whole subject is dealt with in a manner which may be likened to calling in a physician to every boiler, and the cure of the disease (scaling) is not left to mere chance.

The fluid does not contain any volatile ingredients, and cannot, therefore, render the steam injurious; in fact, water condensed from it can be used for culinary purposes.

Further particulars will be given by, or samples of water may be sent to, Messrs. Sidney Minns & Co., Trafalgar road, Dalston, London, E.

SHIPPING APPLIANCES COMPANY'S EXHIBITS AT THE GLASGOW EXHIBITION.

JOHN S. GISBORNE'S patent electric and mechanical ships' telegraphs are included in the exhibit of the Shipping Appliances Company, Limited, 2, Fenchurch Avenue, London, and whose Glasgow agents are Messrs. Norman, Gilmour & Co., 40, St. Vincent Place. The latter firm are also the agents for Tyzack's improved patent stockless anchor, which is the result of careful observation made by the patentee during the progress of Government trials of anchors at Portsmouth. This anchor has the peculiar distinction of being constructed with an additional third central arm, which works at the same angle and upon the same axis as the lateral arms, and which has been designed expressly to steady the action of the anchor by taking the strain upon it in a direct line from the cable, as in ordinary anchors. The anchor rests upon the points of three palms, somewhat in the shape of a triangle, and being thus in a rigid upstanding position is always ready to bite. It is, besides, exceedingly simple in construction, moderate in cost, and can be worked into an ordinary-shape circular hawsepipe.

NEW GUN VESSELS.—An order has been received at Sheerness Dockyard directing two new first-class gun vessels to be built for the Royal Navy. These ships are in addition to the programme of shipbuilding laid down by the Admiralty for the year, and their construction has been ordered so as to avoid the necessity of making further reductions in the shipwright branch. The proposed new vessels are to be of the *Sharpshooter* type. They have been designed by Mr. W. H. White, Director of Naval Construction, and are to be built upon similar lines to the *Spider* and *Sandfly*, but will be larger and possess greater speed than these vessels. They are to have a displacement of 735 tons, and will be 230 ft. in length. Their machinery is to be of the triple-expansion type, estimated to develop 4,500 H.P. under forced draught, with a speed of 21 knots, which will be the highest ever attained by a British ship of war. The armament of the vessels will consist of six or seven quick-firing guns of various sizes, and they will also be fitted with a number of 14 in. tubes for discharging Whitehead torpedoes. They will be fitted with electric search lights and all the latest improvements in shipbuilding science.

LANDORE STEEL WORKS.—The prospect of a prolonged stoppage of the Landore New Steel Works is avoided. Recently, as a result of a conference of directors, it was decided to again blow in the furnaces.

LAUNCH OF H.M.S. "MARATHON."

ON August 23rd Her Royal Highness Princess Beatrice and Prince Henry of Battenberg sailed up the river Clyde to Govan, a suburb of Glasgow, to attend and take part in the ceremony of launching Her Majesty's ship *Marathon*, built at the Fairfield Company's shipbuilding yard in that town for the British Navy. At a quarter to one the Royal party drove into the Fairfield yard and passed to the ship which was ready to be launched. The crowd here and on the banks of the river was very great, there being several large stands erected for the convenience of the public. For the reception of the Royal party a platform had been built just under the bow of the vessel. The guard of honour consisted of detachments of the Seaforth Highlanders and of the 2nd Volunteer Battalion of the Highland Light Infantry, of which Sir William Pearce is the Honorary Colonel. A selection of music was performed by the band of the Bavarian Field Artillery, who attended by special request, while the band of the training ship *Cumberland* occupied a position on the right of the ship. When the Royal party arrived at the vessel they were received with ringing cheers. Leaving her carriage the Princess ascended to the ceremonial platform, attended by Sir William Pearce. She was followed by Prince Henry of Battenberg and the members of the suite. Among the others who followed were Lady Pearce, the Earl of Stair, the Lord Advocate, the Solicitor-General, Sir James Fergusson, M.P., Lord Elphinstone, Sir Edward and Lady Moon, and Sir James Watson. Fully twenty minutes were occupied in the final preparations for the launch, during which Sir William Pearce explained to the Princess and to Prince Henry the mechanical operations in progress. In this interval also the following ladies and gentlemen were presented to the Princess:—Lady Pearce, Lady Moon, Mr. W. C. Pearce, Mr. R. Barnwell, Professor Robertson, Sir William Thomson, the renowned electrician, Mr. John Burns, Mrs. Robertson, Mrs. Berry, and Miss Bain, daughter of Sir James Bain. Thereafter the Divine service observed at the launch of all British warships was conducted by Dr. John MacLeod. The members of the choir of the parish church, who occupied a stand beneath the Royal platform, sang the opening hymn and the National Anthem, with which the service closed. After the service and while the final operations were proceeding for the launch of the ship, Dr. MacLeod was presented.

All preliminary arrangements having been made, the practical part of the ceremony was performed by her Royal Highness. The rope which controlled the last dog-shore holding the ship was bound round the bow of the ship, and above it was fixed an axe with a gold-mounted mallet. Princess Beatrice gently yet effectively struck the axe, cutting the rope, and the vessel thus released at once commenced to move. The Princess stepped forward, raised the bottle that was in readiness, and with a good swing dashed it on the ram of the vessel, naming her the *Marathon*. The *Marathon* continued to glide slowly down the ways, and as she plunged into the water vigorous cheers were raised, and mingled with them were heard the martial strains of "Rule Britannia," played by the band of the training ship *Cumberland*, followed by "God Save the Queen." Meanwhile Sir William Pearce presented to her Royal Highness a lovely bouquet of flowers. The Royal procession was then re-formed and drove to the reception rooms specially built on a site close to the suite of offices and most elegantly furnished. Adjoining these was a marquee, in which a banquet was given immediately after the launch. The chair was occupied by Sir William Pearce, M.P., who had on his right her Royal Highness Princess Beatrice, and on the left Prince Henry of Battenberg.

The *Marathon* is one of five cruisers included in the Navy Estimates last year. Two are building at Chatham, one at Portsmouth, and the remaining two were given out by contract to the Fairfield Shipbuilding and Engineering Company, Glasgow, while the engines were ordered from Messrs. Hawthorn, Leslie, & Co., Limited, Newcastle-on-Tyne. The chief features in the design of these vessels are their general fitness for smart manœuvring, their speed, and their powerful armament. The *Marathon*, like the other vessels of the class, is of moderate dimensions—265 ft. long, 42 ft. extreme breadth, and 23 ft. deep, and her displacement tonnage when fully equipped will be about 3,000 tons. The vessel is built of Siemens-Martin steel, and it is sheathed with two coverings of teakwood, on the top of which is a copper covering. This method of building the hull has only been adopted in the case of the vessels building at Fairfield and at Portsmouth. The ships have an inner bottom extending throughout the length of the machinery and boiler spaces, four in number, and the flats of store rooms, magazine, &c., extend to stem and stern posts, thus giving a double bottom to the entire length of the ship. The space between bottoms is divided into twelve water-tight compartments, for use as water-ballast tanks. The hull is separated by bulkheads into 75 compartments. Running parallel with the load-water line, and, having a decided slope all round, is a protective deck extending from stem to stern. It is of steel 1 in. thick on the horizontal part and 2 in. on the inclined parts. This deck is to protect the machinery, magazines, &c. The latter are situated in the hold at the middle line of the vessel forward, and aft of the engines and boilers. On the platform which forms the crown of the magazines forward are the submarine mining stores and provison rooms, while aft is the steering gear. The machinery is of the twin-screw, horizontal surface condensing type, each engine being placed in a separate water-tight compartment. The diameters of the cylinders are—high pressure, 34½ in.; intermediate, 51 in.; and low pressure, 76½ in.; the stroke of piston being 36 in. The engines are to run at 150 revolutions per minute, and to indicate 9,000 H.P., which will propel the vessel at nearly 20 knots an hour. The total condensing surface is 11,850 square feet. Steam is supplied from four double-ended cylindrical boilers, two in each of the compartments set apart for them. These boilers have 24 corrugated furnaces, with a grate surface of 456 square feet, and a heating surface of 14,070 square feet. They are constructed to work at a pressure of 155 lbs. per square inch. There are four stokeholds, arranged for working under forced draught on the closed stokehold system, air being supplied by eight double-sided fans, driven direct by high speed engines. The coal bunkers are arranged so as to surround the machinery and boilers, both above and below the slope of the protective deck, and will thus afford additional protection. Steel has been largely used in the construction of the engines, and the ram at the bow and the stern tubes and propeller are made of bronze, while the framework of the rudder, which is on the balance principle, is also of solid bronze sheathed with thick gun metal plates. The auxiliary engines in the ship are very complete. The armament will consist of six 6-in. guns, with Vavasseur central pivot mounting carriages—two on sponsons on the upper deck amidships, two on the forecastle, and a couple on the poop deck; nine 6-pounder Hotchkiss quick-firing guns, one 3-pounder boat's gun, and several Nordenfelt machine guns. The vessel has six torpedo tubes, four on broadside and one fore and aft. When in action the movement of the machinery and steering gear and the firing of the torpedoes are under control from the conning-tower on the poop and forecastle. The military tops on the masts are to be dispensed with, so that the cruisers are almost the first built for the British navy without the "crow's nest," and the decision to discard it was only come to after the construction of the vessel was commenced.

THE JOHN ELDER MEMORIAL AT GOVAN.

THE statue of the late Mr. John Elder, recently erected on a prominent site in the Govan Public Park, is a striking one, both from its artistic merits and its dimensions, and well illustrates how the good name of a worthy man is willing, nay cheerfully, perpetuated by the generous instincts of his appreciative fellow townsmen.

The artist, Mr. J. E. Boehm, R.A., has produced at once a notable work of art and a faithful presentment of his subject. The statue, which is in bronze, and ten feet in height, exclusive of the pedestal (of red Peterhead granite and, in turn, 12 feet high), represents the late Mr. Elder, standing erect beside a model of a compound engine, in the introduction of which he took a leading part. In producing the likeness Mr. Boehm was assisted by a bust executed by Mr. Power, of Florence, and the statue was cast at the works of Mr. Moore, Thames Ditton.

On each of the four sides of the pedestal are panels, that in front giving the dates of Mr. Elder's birth and death, while two of the others set forth his varied achievements, the last one giving the date and reason of the erection of the statue.

Among the speakers at the unveiling ceremony, which was performed by the Marquis of Lothian, Secretary for Scotland, were the Earl of Ravensworth, and Sir William Thomson, the latter saying that, not only did John Elder realise his invention of the compound engine, but he foresaw the development of the triple-expansion engine.

THE "SEAMEW."

THE General Steam Navigation Company has just added another vessel to its already large fleet, and on August 3rd, by invitation of Mr. J. H. Tritton, chairman of the company, a number of shareholders and others were invited to inspect the most recent acquisition. The *Seamew*, as the new vessel is called, is the thirty-sixth boat built by the General Steam Navigation Co. within the last 14 years, and is the largest of the fleet. She is intended for the Scotch trade, and in her construction the company have paid great attention to improvements in the accommodation for passengers. The ship is steel built and has a length of 260 ft., the greatest permitted by the ports and harbours between which she will ply. Her beam is 35ft. 6in., her depth 18ft., she has a gross register of 1,330 tons, and her indicated horse-power is 3,550. Speed has been a special care on the part of the constructors, and on her trial trip the *Seamew*, during a four hours' run, made 18 knots, carrying a dead weight of 950 tons. The State cabins are large and airy, opening out upon corridors instead of upon the dining saloon; and the ladies' accommodation is provided by a number of separate cabins in through communication, in each of which a small party can be berthed. The dining saloon is a very handsomely decorated and well-lighted apartment, and in order to enhance the enjoyment of the coasting passage in summer time a boudoir and music room for the ladies has been constructed on the awning deck, together with a well-appointed smoking room for the gentlemen. The cabin under the forecastle deck forms the sleeping apartment for second-class male passengers, a comfortable dining room being provided under the bridge deck. There is also a ladies' second-class cabin and third-class sleeping accommodation, about 220 passengers in all being provided for. Both in the position and in the appointments of the cabins, the comfort of the future inmates has been the first consideration. The electric light is employed throughout. Besides her triple expansion engines, the *Seamew* carries much special machinery.

THE CAPE MAIL STEAMERS.

ON the evening of August 14th Captain J. C. Robinson, of the mail steamer *Norham Castle*, entertained a large company at dinner on board the vessel, previous to sailing for the Cape Colony and Natal. This vessel has just been fitted throughout with the electric light, and it was chiefly to inspect this and other recent improvements that the company were invited. The *Norham Castle* was built about five years ago by Messrs. John Elder and Co. and was then partially fitted with the electric light, but whereas the installation at first consisted of only 62 lights, it now consisted of 320. Each state-room is lighted with a 16-candle power incandescent lamp, which can be turned on and off by a switch at the side of the berth. In the main saloon there are 28 16-candle power lamps, and the new light has been extended to every part of the second and third class accommodation. It is satisfactory to note that the comfort of the third-class passengers has been carefully considered, and with the exception that the space accorded to them is not so large and that the upholstery and decoration in their department are on a less expensive scale, they enjoy every convenience that can be fairly looked for. The port and starboard and masthead lights are also lighted by electricity, and this must be looked upon as a great improvement in view of the greater penetrating power that is thus gained. Another novelty has also been introduced in a shape of a submarine lamp, by means of which the ship's hull and propellor can easily be examined. The generating plant consists of two Victoria dynamos, each capable of maintaining 180 16-candle power lamps, and driven by two independent engines. The whole of the electric lighting contract has been carried out by the Anglo-American Brush Electric Light Corporation. Mr. J. R. Chapman, the manager of the company, took the chair at the dinner, and was supported in the vice-chair by Captain Howson, the commodore of the fleet. Several toasts, including "Golden South Africa," and "Sir Donald Currie," were proposed, and, after a minute inspection of all the improvements above referred to, the company returned to town.

ENGINE CONTRACT FOR PAISLEY.—Messrs. Fleming & Ferguson, engineers and shipbuilders, Paisley, have secured a contract for four sets of their patent improved quadruple-expansion engines for four steamers for South America. The hulls of the steamers are to be built by a firm in England.

AN INTERESTING YACHT MODEL.

TO the yacht-racing public the Glasgow Exhibition contains one of the most interesting models that has been shown in any of our International Exhibitions. This is the model of the 25-ton cutter *Tiara*, built by Messrs. Simmons, of Renfrew, in the year 1850, the year previous to the famous American schooner-yacht *America's* arrival at Cowes, where she won the Queen's Cup, contested for by *Thistle* and *Volunteer*. That the long sharp bow and build of the *America* made a revolution in British yacht-building cannot be contested; but the *Tiara's* model shows a British shipbuilder was in advance of the American designer. Indeed, the model of the *Tiara* proves that her designer saw years ahead of other builders, since not only the bow but the stern of the *Tiara* were a long way in advance of anything built at the same date. A close examination of the model will show resemblances to quite modern yacht models, where a return to the round side and greater beam of previous years has been promoted by the sail area measurement. With lead ballast and a rounded forefoot the *Tiara* would look a comparatively modern boat, and why her merits were not acknowledged at the time she was built may be partly explained by the old adage of prophets in their own country. The *Tiara*, as the writer recollects her in 1850, was a handsome-looking boat, with a light quarter and fine counter, compared with the heavy square tucks in vogue at the time. She carried a square-looking mainsail, without the high peak then in fashion, and was able to beat Hatcher's famous *Phyrnne* in Loch Ryan in a breeze of wind, and without any allowance of time, although Hatcher's boat was about double the tonnage. Unfortunately the records of yacht-racing were meagre at the time, otherwise *Tiara* must have been better known. She eventually carried her mast over the side in Dundrum Bay, and was lost. Yachting men owe Mr. Simmons an exceptional debt for showing the *Tiara's* model, and which exhibit ought to attract all the attention it deserves. Among yacht designers Mr. G. L. Watson acknowledges in the frankest way the exceptional science and foresight displayed in the *Tiara's* model. Another yacht built by Mr. Simmons after the *Tiara*, supported the *Tiara's* claims as a departure from contemporary building. This was the schooner *Chance*, built for Mr. David Richardson at Renfrew, and afterwards lengthened by the stern by Mr. Steel, of Greenock. This schooner gave Mr. Simmons more scope for his long bow, and the *Chance* proved a very fast vessel, her record showing her more than a match for some of the best vessels of her time. After an eventful career she was sold out to Australia, and lost sight of.

COMBINED CIRCULATOR AND FEED WATER HEATER FOR STEAM BOILERS.

WE have received an interesting report from Mr. Daniel Thomson, of 83, Canton Street, Poplar, E., the inventor of the above-named system of heater, of some interesting trials recently made by him on the boilers of the s.s. *Mirror*, the second of the Eastern Telegraph Co.'s ships which has been fitted with Thomson's Patent Combined Circulator and Feed Water Heater.

The fires were lighted in the main boilers and at the same time steam was turned on from the donkey boiler to the circulating chambers, and with 40 lbs. of steam in the donkey boiler, the following highly satisfactory results were obtained:—Temperature of water in the bottom of main boilers at 10 a.m., 60° Fah.; at 10.30, 76°; at 11 a.m., 90°; at noon, 106°; at 12.30 p.m., 140°; at 1 p.m., 200°; and at 1.30 p.m., 212°, with 50 lbs. pressure of steam on main boilers, thus doing away with all undue strains while raising steam.

The circulating action, when employing Mr. Thomson's system of heaters, is very perfect, and is maintained by each impulse of the feed water removing the bottom water to the surface at each fresh supply to the boiler.

We may state that the s.s. *John Pender*, which had the system applied to her boilers, has been at work, so fitted, for the last twelve months and is giving the utmost satisfaction.

SHIPBUILDING CONTRACTS FOR CAMPBELTOWN.—Biggart & Fulton, 24, George-square, Glasgow, have concluded a contract for a steamer 3,300 tons dead-weight, to be built under special survey to the highest class at Lloyd's, by the Campbeltown Shipbuilding Co., with all the latest improvements for a cargo steamer of her class.

THE "GREAT EASTERN."

THE steamship *Great Eastern*, which has passed through so many vicissitudes since her launch 30 years ago, was successfully beached near New Ferry on the Cheshire shore of the Mersey on August 25th. Since last December, when she became the property of Messrs. Henry Bath and Co., of Liverpool, the *Great Eastern* has been moored in the Clyde between Helensburgh and Greenock, and in the inspection which she has undergone unsuspected value is said to have been discovered. On Wednesday, August 22nd, at noon, she was got under way, and started on what is intended to be her last voyage. With her own steam she could make a speed of four to five knots, but she was towed by the powerful steam tug *Stormcock*. The weather was bright when the vessels started, but next morning the wind freshened, while dark masses of clouds presaged the dirty weather that followed. The gale was at its highest when the vessels were off the Isle of Man about 6 o'clock on Thursday evening. The tug cast loose the hawser, which seemed an impediment to navigation, and while the engines of the big ship were stopped for a while she became practically unmanageable, the gale having full play against her hull, which was very high out of the water. For four hours she was rolled about at the mercy of the seas. Heavy goods on board were dashed about below, while the funnels swayed as if about to be dislodged. Despite her 40 feet out of the water some of the great seas swept over her, and a large gangway was torn from its chains and carried away. The 100 men, principally "runners," who formed the crew were much alarmed at the various reports about the damage done. At length she was got to windward, and the course was directed to the Irish coast; but the gale moderated, and on Friday morning the *Stormcock* (which had kept near) resumed the towing of the ship, which reached the bar of the Mersey at 5 o'clock on Friday evening. It being too late for the tide, she was anchored until about 10 o'clock on Saturday morning, when the passage was resumed, and in the early afternoon her progress up the river was watched by many thousands of spectators. About 100 yards from the New Ferry shore the tugs (the *Pathfinder* as well as the *Stormcock*) cast off, and in a few minutes the vessel grounded without any perceptible shock in much shallower water than was expected. She appeared to become more tightly embedded at the after-part of the keel, for after she had discontinued going forward her bow was carried several yards to the northward by the tide. The *Great Eastern* now lies about 200 yards to the southward of the New Ferry stage. It is said that the ship will now be broken up and the materials sold, but there are persons who believe that some use will yet be found for the vessel designed by Brunel.

THE OCEAN RACE.

QUEENSTOWN, AUG. 25.

THE ocean race between the *Umbria* and the *City of New York*, which has put all Queenstown agog with excitement, has ended in a decisive victory for the Cunard steamer *Umbria*, which was first sighted off Browhead at 4·13 a.m. this morning. Of course the representatives of both companies strenuously denied that there was any contest between the vessels, but this notwithstanding, it was expected that there would be a struggle for the supremacy of the Atlantic. The *Umbria* left New York at 4.10 a.m. on the 18th. The *City of New York* started one hour and 20 minutes later, so that victory remains with the former, who has fallen short of her swiftest record of six days, five hours, and 40 minutes by three hours. As to speed and comfort the *Umbria* is only second to her sister ship, the *Etruria*, which holds the Transatlantic premiorship. The *City of New York*, which has not yet been signalled, did her maiden trip to New York in six days and 21 hours—a record which, considering the newness of her machinery, bids fair to be soon beaten by the same vessel. This latest acquisition to the Inman Line was added thereto in the hope that she would wrest the laurels of the Atlantic from all competitors, and her failure so far is no criterion that on a future occasion she may not dwarf previous records of other contestants. Naturally the greatest excitement prevailed when it became known that these two leviathans were put each against the other, and bets were freely offered, and as quickly accepted, not alone here, but on the Clyde, where the vessels were built, as to the chance of each ship being victorious. The *Umbria* was, however, the favourite all through, five to one being readily laid on her. The following is a copy of the *Umbria's* log, from which it can be seen that she made the passage from Sandy Hook to Roche's Point in six days, 10 hours, 29 minutes, and steamed 2,883 miles. It was only during the three last days of the voyage that anything like bad weather was experienced:—Left New York at 2.45 p.m.; 18th, 4 p.m., Sandy Hook abeam; 4·15, full speed on. 19th.—Wind south-west, light breeze; distance covered, 344 miles. 20th.—Wind south-west to north-west, light, 430 miles. 21st.—north-west, moderate, 445 miles. 22nd.—North-west, moderate, fresh gale, 441 miles. 23rd.—West north-west to north-west, moderate to fresh gale, squally, 436 miles. 24th.—North-west, moderate gale, 458 miles. 25th.—Arrived off Roche's Point, 7·30 a.m., 439 miles.

AUGUST 26.

The Ocean race between the Cunarder *Umbria* and the Inman and International new steamer *City of New York* has come to an end, and all interest and excitement subsided at 7·5 this morning, when the latter steamer was sighted off Browhead exactly 26 hours and 52 minutes behind the *Umbria*. Four hours later she was off Roche's Point, having made the passage from Sandy Hook to Roche's Point, in seven days, 12 hours, and 23 minutes, being 26 hours four minutes longer than her rival. The distance run was 2,811 miles, whereas the *Umbria* covered 2,883, being 72 miles more than the *City of New York*. During the passage very fair weather was experienced, and only on two days was anything like bad weather encountered. There was very little difference in each day's run, the running being evidently equalised as much as possible, and the steamer not being driven on any occasion at full speed. Her port engines were stopped three times during the passage, and her starboard engine twice, but this stoppage of the engines alternately did not necessarily bring her to a standstill, for being a twin-screw vessel, while one engine was stopped she was propelled by the other, which is considered a great advantage to a Transatlantic liner. However, the delay caused by the stoppage of her machinery is estimated at about 11 hours. It is expected after a few more trips, when the machinery gets into proper working order, that she will fully realise the expectations of her owners and builders. Her passengers speak highly of her sea-going qualities, and of the accommodation and treatment they received on board. The following is a copy of the log:—Left New York at 3·20 p.m., and Sandy Hook at 5·54 p.m. on the 18th inst. At noon on the 19th inst. 298 miles were covered, wind light from south-west. 20th.—Wind light and variable, 365 miles. 21st.—Light and variable to moderate, 376 miles. 22nd.—West-south-west to north-west, strong breeze with beam sea, 366 miles. 23rd.—North-north-west to north-north-east, strong breeze, with beam sea, 361 miles. 24th.—Northerly, strong to moderate breeze, 343 miles. 25th.—North-west to south-west, moderate, 340 miles. 26th.—West, moderate, 262 miles, stopped at 11·5 a.m. off Roche's Point, and after transferring several passengers to be landed at Queenstown to the tender continued on to Liverpool. —*Times*.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from July 26th to August 25th, 1888:—

Agnew, Thomas, chief engineer to the *Rapid*, reappointed on promotion to date July 27th.
Gibbs, Alfred W., engineer to the *Asia*, to date August 18th.
Jackson, R. E., acting assistant engineer to the *Monarch*, to date August 25th.
Jenkins, J. H., acting assistant engineer to the *Malabar*, to date August 25th.
King, Quentin W., engineer to the *Partridge*.
Lister, F. H., assistant engineer to the *Serapis*, to date August 25th.
Liversedge, Henry T., engineer to the *Watchful*.
Moysey, William H. S., acting assistant engineer to the *Euphrates*, to date August 25th.
Phillips, Richard, engineer to the *Hecate*.
Purkiss, J. T., engineer to the *Crocodile*, to date August 25th.
Rutter, E. J., assistant engineer to the *Tyne*, to date August 25th.
Thornhill, Ernest C., acting assistant engineer to the *Serapis*, to date August 25th.
Tomkins, A. E., assistant engineer to the *Media*, to date August 25th.

HOAR & BROWN'S HARDWOOD MARKET REPORT, 24th August, 1888.

TEAK.—The deliveries for the past four weeks ending 17th August were 1830 loads, and the total deliveries for the year up to the same date were 11,004 loads, whereas for the whole 12 months in 1887 the deliveries were only 12,190 loads, against 11,144 in 1886, and 10,899 loads in 1885.

For the whole month of August last year only 435 loads left the public docks.

These extraordinary deliveries are due to the great revival in trade, and are no doubt in some measure also due to the recent panic in the freight market, consumers being anxious to cover their contracts while there are still sellers at reasonable rates.

The stock is being greatly reduced, and at the beginning of the month stood at 9,300 loads, 11,989 loads in 1887, and 14,601 in 1886.

Both the shipbuilding yards and the railway carriage builders are very busy, large orders having been recently given out, with a prospect of much larger ones in the immediate future. If the freight market continues to rise in the same extraordinary ratio as recently, the shipbuilding trade must of necessity improve, as fresh orders for tonnage are sure to be given out. The deliveries also are not likely to decrease, as we know of several large contracts that have still to be executed.

MAHOGANY.—Business has been exceptionally quiet in this wood. The stock of Honduras is one of the smallest we have had for years past, and from advices received it is not likely to be increased for some considerable time. Cuba wood, of which there is a fair stock, has been sold rather freely on account of the low prices ruling. Two cargoes of Laguna wood were sold during the month, leaving the Tobasco stock considerably reduced. Advices from the shipping districts show that the season's import will be very moderate. If this is so a very considerable rise in prices must follow.

GREENHEART.—The stock is now reduced to a very small compass, and prices are considerably advanced. The deliveries have been 75 loads, leaving the stock at 478 loads.

WALNUT.—Some important sales of cut stuff have been made during the last week, stocks of boards brought over at the low freight of 7s. 6d. enabling dealers to place a considerable quantity in consequence of the freights having now advanced. The very large quantity of inferior walnut logs which are now landed here tend to lower prices. At the last auction a parcel of small sound timber was knocked down at 2s. per foot, and as there are about 2500 logs in stock at the docks we expect to see even lower prices ruling. For really prime logs fit for the knife good prices are obtainable, as much as 5s. to 5s. 6d. being paid by consumers for small parcels. Out of the large quantity now here only about 100 to 200 logs could be found of really a mild character.

CEDAR.—There is little or no change in this wood, and nothing of interest being done.

SEQUOIA.—Some more large sales are reported at low figures, and stocks are being considerably reduced. No fresh arrivals are expected this year.

WHITEWOOD has been going a little better lately, an advance of about 2d. per foot cube being paid for logs since our report of last month.

HOPPER DREDGER FOR JAPAN.

THE Patent Hopper Dredger "Lode-ga-ura-Maru," recently constructed by Messrs. William Simons & Co., Renfrew, for the purpose of effecting harbour improvements in Japan, has completed her trials on the Clyde with very satisfactory results.

The construction of the bow of this vessel is a novel arrangement of the builders, and is designed specially to enable the buckets to dredge close to quay walls, and also dredge from water level to a depth of 30 feet.

Its hopper has a capacity for 300 tons of dredgings, and the side shoots are so constructed as to be capable of filling hopper barges alongside as well as its own hopper cavity.

The dredging gearing is adapted for working either in hard or soft material, and has a bucket-lifting capacity of about 300 tons per hour.

Steam mooring winches are fitted at bow and stern for head and side cutting, having treble barrels, each working independently.

The engines are compound surface-condensing type of 250 indicated horse power, the boiler being of steel, constructed for a working pressure of 90 lbs. per square inch.

ENGLISH AND FRENCH WARSHIPS.

LORD WEMYSS has prepared a tabulated statement of the comparative naval force of Great Britain and France, the figures being taken from the English Official Navy List of the 1st of January, 1888, and from a French Parliamentary report of about the same date to the French Minister of Marine. Admiral Sir R. Spencer Robinson, who signs the table, has made it as nearly as possible representative of the effective strength by excluding from consideration ships appearing in the Navy List of last month as ordered to be built or preparing to build.

The armoured vessels have been classified "in the way which has been adopted by professional officers of high distinction and much experience," and the result is that of ships "universally considered fit for the purpose of modern warfare at sea" we have twenty-seven and France twenty-two, which, in the opinion of Sir R. Spencer Robinson, may be considered, ship for ship, fairly equal. Of vessels not fit for all services at sea—sometimes designated coast defence ironclads—England has 9, France 11—the latter being inferior, ship for ship, to the former; while six of the English boats might accompany fleets, though unable to blockade at all times and places. The two nations have each six ships, ranked as second-class ironclads, fit for general service at sea—though quite obsolete in respect of power. The English ships, though inferior in armament, are superior in material, the French vessels being wooden built. Class D, "Unfit for war purposes," closes the list, thirteen being English and eight French. Referring to worn-out and obsolete English ships, described as not effective until repaired, Admiral Robinson remarks:—"Whoever orders such ships to be repaired will have incurred the responsibility of a serious expenditure of time and money without adding a particle of efficiency to the British navy."

Our strength in unarmoured men-of-war is measured by the number which "could strike a blow for the defence of commerce on one side, and such as are adapted for its destruction on the other." Thus, under 10 knots speed we have one "productive," while the French have six "destructives." Including these and all up to 15 knots we have 79 against France's 64; from 15 knots up to and including 20 knots we have 40 against 28. Outside our list altogether come 9 "Torpilleurs de Haute Mer" of 22 knots, whose destructive powers would only be exerted in good weather and near French ports. There is also one cruiser of 25 knots, and four vessels are entered as "speed not recorded." We have 12 armoured cruisers, the three best being of 19 to 20 knots; and the French have five, four slow of the little value, and one of 19 knots. In addition, France has 32 second-class avisos or despatch boats up to 11 knots speed. It is urged that these figures, in view of the difficulty of maintaining a perfect blockade, show the necessity for a very large augmentation in the number of our fast cruisers and the increase of our blockading power.

THE ITALIAN NAVY.

A NEW cruiser for the Italian Government, named the *Piemonte*, has just been launched from the shipyard of Sir W. G. Armstrong, Mitchell, and Co., at Elswick. The christening ceremony was performed by Mrs. Watts, the wife of Mr. Watts, the designer of the vessel. It was expected that Count Candiani, the Naval Attaché in England, would have been able to be present on the part of the Italian Government, but urgent business unfortunately prevented him from visiting Newcastle. In his absence his place was supplied by Major Nabor Soliani and Captain M. G. Taruffini, of the Italian Naval Construction Department. The *Piemonte* is the third cruiser which Sir W. G. Armstrong, Mitchell, and Co. have constructed in a very short period for the Italian Government. The first was the *Giovanni Bausan*, built in 1885; the second was the *Dogali*, constructed at Elswick last year; and the third is the *Piemonte*, now in course of completion. In type the *Piemonte* is an intermediate between the *Dogali* and the *Bausan* cruisers. Her approximate dimensions are—length 300 ft., breadth 38 ft., and depth 23 ft. She is of about 2,500 tons displacement, and carries engines of about 12,000 indicated horse power, which it is reckoned will give her on trial a speed of over 21 knots. When completed it is thought that she will prove the most powerful war cruiser of her size and pattern. It is expected that the *Piemonte* will be finished and ready for departure from the Tyne by the end of the year. After the launch, those present adjourned to the model room, where success to the *Piemonte* was proposed by Lord Armstrong, who said this

was the third ship of the protected cruiser type which this firm had had the honour of constructing for the Royal Italian Navy. Each of the two preceding ships was at the date of her completion the swiftest and most powerful vessel of her day, and he believed that the present cruiser, when she left the Tyne, would be the swiftest and most powerful armed of her class in existence. Major Soliani, in responding, said he very much regretted the absence of Count Candiani, who would have been much better fitted to respond to the address of Lord Armstrong. He wished a long and very successful career to the distinguished Elswick firm.

INDUSTRIAL NOTES.

CLYDE AND EAST OF SCOTLAND.

THE Clyde shipbuilding trade and kindred industries have remained in a thoroughly healthy condition throughout the month, and there are distinct signs on all hands of continued briskness in this important department of labour. This is at once transparent when we state that, during the month of July, 21 new vessels, with an aggregate of nearly 24,000 tons, were launched from Clyde yards, against 14 vessels of 8,770 tons in July, 1887, and 18 vessels of 17,700 tons in the corresponding month of 1886. During the seven months ending 31st July last, 119 vessels, aggregating 118,352 tons, were launched, compared with 85 vessels of 96,066 tons for the first seven months of 1887. During July 16,000 tons of new work were booked, and during August quite a large number of fresh orders for ships of various types were obtained by local builders. Summarised, these are as follows:—Messrs. J. & G. Thomson, of Clyde Bank, an order from the British Admiralty for two warships of 2,600 tons each, and a contract for a new steamer of large dimensions from the Red Star Line; Messrs. Russell & Co., Greenock, an order for two iron sailing ships, of 2,500 tons each, for Liverpool firms; Messrs. Hamilton & Co., Port Glasgow, an order for a steel screw steamer of fully 2,000 tons, also for Liverpool owners; the Fairfield Shipbuilding and Engineering Company, Govan, an order for a steel paddle-wheel steamer for Mr. John Burns; and Messrs. Scott & Co., Greenock, a contract for a 500-ton iron barge for service on the China coast. Several firms are, in addition to the above, credited with orders for ships of varied tonnage; but as these are based on mere rumour, they cannot be said to count. None of the new work is possessed of any special feature, with perhaps the exception of the warships which the Messrsr Thomson have been instructed to build for the Admiralty. These vessels are two of six which are to form the Australian Defence Squadron. They are of the deck-protective type, similar to the Spanish cruiser *Reina Regente*, built 18 months since by the same firm, and are intended to attain a speed of 18½ knots.

Several important marine contracts have also been booked during the past month, amongst which we note an order obtained by Messrs. Fleming & Ferguson, Paisley, for four sets of their patent improved quadruple-expansion engines for steamers for South America, the hulls of which are to be built by an English firm of shipbuilders.

Respecting the prospects for the future, these are, beyond question, exceedingly encouraging. The inquiries are numerous, the prices obtained fairly satisfactory, while the export freightage charged from Scotch ports have been, generally speaking, unusually high.

The steel and the other industries allied to the shipbuilding trade are likewise very busy with the execution of orders, and an uninterrupted vitality continues to permeate the metal market, remarkably good prices having been secured during the month for the various kinds of goods dealt in.

A number of Clyde built vessels have changed hands within the last few weeks. The *Janet Cowan*, an iron ship of 1,278 tons register, has been sold by the owners, Messrs. Shankland & Co., Greenock, to Mr. Simpson, of Swansea; and the paddle steamer, *Sea Gull*, 107 tons register, has been sold by Messrs. Steel and McCaskill, Glasgow, to an agent representing a Russian firm.

The announcement made by the *Standard*, viz., that the Japanese Government purpose expending ten millions sterling on the purchase of ironclads, has set Scotch shipbuilders on the *qui vive*, and strong hopes are entertained that at least a portion of the work will come to the Clyde. As above hinted, we have a good deal on hand just now, but still "there's room for more!"

The success which attended the maiden voyage of the new Inman liner *City of New York* has, I hear, given complete satisfaction to both builders and owners, and the rumour is current that four additional "cities" will probably soon be contracted for. It is expected that the *City of Paris*, sister ship to the former named, will be launched on the 1st of September.

Thirty-two steamers, carrying 48,867 tons of Spanish ore, arrived in the Clyde during July, which, compared with July, 1887, shows an increase in the receipts of over 16,000 tons.

A statue in memory of the late John Elder, the pioneer of the marine compound engine, was unveiled at Govan, near Glasgow, on the 28th July, by the Marquis of Lothian, Secretary for Scotland.

A successful demonstration of the working capabilities of Henderson's patent collapsible boat was given in the river Kelvin, within the Exhibition grounds, on the 14th August. This small craft has been designed to meet the necessity for improved life-saving appliances at sea.

As was naturally to be expected, the improvement in the local shipbuilding trade has already resulted in several disputes between employer and employed. It is, however, gratifying to learn that these have, in almost every instance, been amicably settled, the men generally receiving a small advance in the current rates paid. The same cannot be said respecting the Scottish miners, who are at present "agitating" in nearly every mining district throughout the country for an advance on their wages. These misunderstandings unfortunately threaten to prove of a protracted nature.

The third (which is also the final) annual report of the Committee of Greenock Harbour Trust Bondholders is amongst the "interesting documents" recently issued. The report states that the revenues of the Trust "have not shown much increase during the past eleven months," the gross revenue for that period being £43,797. Still, it is expected that, with the prospects of larger imports, and the material improvement in the steamship building trade, that these will tend to bring about a better return of revenue at no distant date. The committee believe that the new constitution and administration of the Trust will do much to improve its finances, and "if the Trust be managed with energy and economy, every confidence may be felt that the present difficulties will soon disappear, and prosperity prevail in the future." Let us hope so, say we, the unhappy bondholders.

Mr. Arroll, of Forth Bridge fame, is stated to have purchased the large engineering works at Ayr, known as the Vulcan Foundry, and previously occupied by the firm of J. & T. Young.

A considerable addition is about to be made to Summerlee and Mossend Iron and Steel Works (Messrs. Neilson's). The works are situated at Coatbridge, about ten miles from Glasgow, and are among the largest concerns of the kind in the West of Scotland.

The Clyde Trustees are busily preparing for the annual inspection of the various harbour works in progress, the chief of which is the construction of an extensive shipping dock at Govan, the completion of which is likely to effect a sort of revolution in the Clyde shipping trade.

An interesting biographical sketch, with cartoon portrait, admirably executed, of Mr. A. C. Kirk, LL.D., the acknowledged inventor of the triple-expansion engine, was recently published in the *Bailie*, a local semi-comic journal.

A correspondent in a local newspaper claims for Scotland the title of "naval power," in support of which he states that "shipbuilding was extensively carried on in Scotland about the beginning of the sixteenth century." The statement, whether true or not, cannot be other than interesting to the modern disciple of marine engineering.

A gentleman who recently returned from a visit to the shipbuilding yard of Messrs. Harland & Wolff, Belfast, informed the writer that 5,000 men are presently engaged in Belfast yards constructing vessels aggregating 60,000 tons, while thirty years ago only 100 men were employed in that industry. He says that the most important work which the Messrs. Harland & Wolff have presently on hand is two large steamers being built for the White Star Line. The exact dimensions of the steamers he was unable to ascertain, but avers that "they are the largest vessels in the world, excepting the *Great Eastern*.

THE NORTH OF SCOTLAND.—The shipbuilding industry on the Tay is presently in a fairly active condition, several orders for new vessels having been placed with local firms in the course of the bygone month. Among these is a contract for a steel barque of 1,300 tons, obtained by Messrs. A. Stephen & Sons, Dundee, from Messrs. Brownell & Co., of Liverpool. Another firm, whose yard is located in the same district, have just laid the keel of a large stock steamer, which will provide work for a good number of men.

The directors of the Dundee, Perth, and London Shipping Company have presently under consideration a proposal for building a new cargo steamer capable of carrying 2,500 tons, though no definite decision has yet been arrived at in the matter.

Trade disputes have been somewhat rife in this quarter of late. The Dundee joiners asked for, and after the usual strike obtained, an advance in their wages; the female mill-workers of the same town sought, and likewise received, a similar increase; and about the middle of the month the boiler-makers, platers, and riveters employed in the Aberdeen shipbuilding yards came out on strike for an advance of pay. The latter affects about 300 men, and up to the present date the dispute has not been settled.

The new steamship, *Glaneuse*, built by Messrs. Alexander Hall and Co., Footdee, Aberdeen, for Messrs. Chevellote Frères, Brest, made her trial trip about a fortnight since, when a mean speed of 10 knots was obtained.

It was stated at a recent meeting of the Aberdeen Harbour Commissioners that the revenue of the harbour for the nine months ending 30th June last showed a total increase of £2,315 over the income for the corresponding period of 1887.

No new development has taken place of late in connection with the Leith shipbuilding trade. One or two small vessels have changed hands at that port during the month, but the prices obtained are not entitled to special notice.

Rather a smart passage was made from London to Leith a few days since. The steamship *Meteor*, owned by the London and Edinburgh Shipping Company, left Gravesend at 2.15 p.m. one day and arrived at Leith at 2.35 p.m. the next day. This is believed to be "the fastest passage on record" between these two ports.

The *Great Eastern*, after lying at the Tail of the Bank for some months, has now been taken to the Mersey, where the huge vessel will meet its final doom. It is to be broken up.

The 23rd of August, 1888, was a memorable day in the annals of Clyde shipbuilding. Three vessels, aggregating 7,500 tons, were that day put into the water within a radius of two miles, and two of the launches were witnessed by members of the royal family, the Queen having witnessed the launch of a steel barque at Yoker, and the Princess Beatrice (as elsewhere stated) having performed the christening ceremony of H.M.S. *Marathon* at Govan. The "scene" at the last-named was, perhaps, the most impressive of the kind which has taken place at a launching ceremony here for many years back.

A goodly number of new vessels have left the ways in the course of the past fortnight, and the total output for August promises to be quite in keeping with the healthy statistics of the last few months.

It is generally conceded that one of the most instructive sights of the Glasgow Exhibition is the great number and variety of machines and ship models, &c., which have been brought together within the artisans' department. The ingenuity displayed in many of these is highly complimentary to their humble authors, and shows what remarkable achievements may be accomplished by working men by a judicious utilisation of their talents during leisure hours.

Up till the 23rd August the number of visitors to the Exhibition (including attendants) topped three millions.

TRADE NOTES FROM THE TYNE, WEAR, TEES, &c.

BUSINESS in the shipbuilding industry is now showing considerable animation, and the somewhat sanguine expectations which were expressed in last month's report about this matter seem to be in a fair way of being fulfilled. Inquiries for cargo-carrying boats of large tonnage are increasing, among other contracts now open to competition being one from the Magnetia Iron Mountains Smelting Company, Limited, for three large-sized steamers to be employed in the new trade they are beginning to develop between Sweden and this country. An important order for cruisers, to be employed in the Colonial service, has been placed by the Admiralty with Messrs. Armstrong, Mitchell & Co., who have also received recent commissions from foreign governments for the building of vessels of a similar class. The yard belonging to the firm at Elswick, which for some months past has been practically idle, is now showing signs of returning briskness, and in the course of a very few weeks will once more have all its extensive resources utilised. The firm's yard at Low Walker remains exceedingly busy, the whole of the berths being occupied with oil-carrying steamers of large tonnage, several of which are yet in very early stages of construction. Messrs. Hawthorn, Leslie & Co. have commenced the carrying out of important alterations in the Italian steamer *San Martino*, and they are also repairing a vessel which has been placed in the graving dock for the purpose. Messrs. Palmer & Co. are about to launch from their Howdon yard a vessel of exceptionally large size, which has been built to the order of London owners, and is to be named the *Apex*. Including the vessels which are in the initiatory, as well as those that are in advanced stages, the firm have not less than twenty in hand just now, and the aggregate tonnage of these may be approximately stated at 40,000 tons. Messrs. Swan & Hunter have recently sold to an Italian Company a vessel which had lain on their hands for a considerable period. The vessel, which was named the *Citta di Roma*, is now being got ready for sea. Messrs. Edwards & Sons are preparing to launch from their yard at Howdon a vessel which has been built to the order of local owners, and is to be named the *Elleanor*. The vessel is the last on the stocks, and it is stated that as soon as the launch takes place the yard will be closed. Messrs. R. Stephenson & Co. have launched the first of two composite light-ships ordered by the Trinity House. The second is well advanced towards completion, and there are besides three large steamers on the stocks. In the engineering establishments the pressure of work increases, and the available labour in the district is now fully absorbed. At the Wallsend Slipway Company's works there are no less than four sets of engines and boilers awaiting the boats for which they are intended. Boiler-making establishments are generally doing a most active business, repair contracts constituting a large proportion of the work in hand. The firms who devote themselves to the manufacture of steering gears and similar specialities continue to be well supplied with orders, and in some instances delivery cannot be guaranteed as soon as desired. Messrs. Donkin & Nichol, of the St. Andrew's Engine Works, Newcastle, are doing a large business just now with the leading shipbuilding firms on the Tyne and Wear, their steering gears, telegraphs, ventilating fans, &c., being in great request for steamers of a special class. In the steel and iron manufactories the activity noted in previous reports is undiminished, and the production of patent anchors at Messrs. Spencer's Works, Newburn, and Messrs. Abbot's Works, Gateshead, is almost unprecendentedly large. Messrs. S. T. Taylor and Son, Pipewellgate, Gateshead, have obtained the contracts to cover with their patent Tyneside cement the boilers and steam-pipes of the two largest merchant vessels ever built in the north. These are the *Alfonso XII.*, built by Messrs. Richardson & Co., Low Walker-on-Tyne, and the *Transpacific*, built by Messrs. Doxford, Sunderland. It need scarcely be stated that both vessels are of the highest class, and are elaborately fitted out in all respects.

The Wear.—The feeling of doubt which existed some little time ago in this district, owing to claims for advances of wages having been put forward by the different sections of operatives, has now entirely passed away, amicable settlements having been arrived at in every instance. Since the last of these settlements has been made, indeed, a degree of buoyancy has been imparted to the industry which was scarcely noticeable before, and certain it is that builders are pushing forward the execution of contracts with greater energy. Messrs. Priestman & Co., who only commenced operations a few weeks ago, after a long stoppage, have now two good-sized vessels in course of construction, and are arranging for the laying down of a third, which will be much larger than either of those now on the stocks. Messrs. W. Doxford & Sons have booked some orders lately, one of which is for a vessel of more than ordinarily large dimensions, having been obtained from a local shipowning firm. Messrs. Short Brothers are daily receiving large quantities of material in their yard, and are maintaining a high rate of briskness throughout the different departments. At Mr. Laing's yard active progress is being made with the building of a large vessel intended for the India passenger trade, and there are also several cargo boats, of more than the ordinary dimensions, in progress. Messrs. R. Thompson & Sons are commencing the construction of a steamer which is to be exclusively employed in the oil trade, and they have another in course of plating, which, though of exceptionally large size, is only meant for employment as an ordinary cargo boat. The firm are doing a satisfactory business with their graving dock, which is seldom without an occupant. Messrs. S. P. Austin & Son are busily completing a vessel which is intended to form an addition to the Marquis of Londonderry's fleet of steamers, and they have other new vessels in progress,

besides some repair contracts. Messrs. J. L. Thompson & Sons are keeping their frame furnaces in operation night and day, and are launching an average of three vessels in two months. The firm have recently sold to an Australian company a small steamer, named the *Lancashire Witch*, which was built last year for the Liverpool and Isle of Man passenger service, but which come again into the builders' hands a few weeks ago, through the payment of the purchase-money not having been completed. The vessel, which is built on fine lines, can be made to develop a high rate of speed, and will doubtless prove a valuable acquisition to her present owners. The Strand Shipbuilding Company are preparing to launch a vessel built for local owners, and are proceeding with the framing of another. Messrs. Bartram & Haswell have been commissioned to build a large vessel for the Nautilus Steam Shipping Company, which will make the seventh built by them for the same owners. In marine engineering, business is still extremely active, and several new contracts for engines have recently been placed. At the Palmers' Hill Works there are more than twenty sets of engines in the progressive or preparatory stages, and at some of the other larger factories the amount of work in hand is equally great. A first start was made with the engine and machinery at the Scotia Engine Works on the 20th inst. The power evolved, however, is for the present only required for the use of the pattern-makers. The firm have got orders for some half-dozen sets of the improved type of engine they propose to manufacture, and it is understood that they are now in negotiation for some heavy repair contracts. A Fairbairn crane which has been manufactured by Messrs. Davis & Primrose, Leith, and which will be capable of lifting up to 50 tons, is now being erected in a suitable position on the new jetty, and by the time this indispensable appurtenance is properly fixed it is expected that the arrangements will permit of all the departments getting under way. In the smaller works generally business is active, and iron-founders are more pressed with orders than they have been for years. Brass foundries and coppersmiths' shops are having their resources very fully utilised. In the forges the greatest activity prevails, and chain works are steadily employed. The iron works of Messrs. Samuel Tezzack & Co. continue to be kept in full and regular operations, the demand for Bell and Rockliff's patent sections, which are manufactured here, being steadily on the increase. The rolled packing and other specialities manufactured by this firm are also in great request. The demand for Wasteneys Smith's well-known patent "stockless" anchors has of late been very great, one builder alone having just placed an additional order for six large outfits, and many of the vessels lately fixed for have these anchors specified.

The Hartlepools.—Several launches have taken place at the Hartlepool yards during the month, but in all cases keels for other vessels have replaced those put off the stocks, and the whole of the building berths are now occupied. Some good repair contracts have come to this port recently, and business is on the whole very active in the shipbuilding establishments. The engineering shops remain very busy, and both forges and iron works are in full swing. Timber imports are now very numerous, and business at the docks is consequently more animated than at an earlier period of the year.

The Tees.—The shipyards on the Tees have fully participated in the improved business now generally manifested in the shipbuilding trade, the yards in which the activity is most marked being Messrs. Raylton, Dixon & Co's., Messrs. Duck, Richardson & Co.'s, and Messrs. Braig, Taylor & Co.'s. At Messrs. Blair & Co.'s marine engineering establishment, Stockton, a very great pressure of work continues to exist; and Messrs. Westgarth & English's factory, Middlesboro', is also very fully employed. Steel works keep busily employed, and in the finished-iron manufactories there is a better trade doing. The pig-iron trade at this centre is also showing more animation.

THE MERSEY.

THERE is a little more activity in the shipbuilding yards just now. Messrs. Evans & Co. have secured a contract for a large sailing ship for Messrs. Thomson, Anderson & Co.'s "Sierra" line. Messrs. Royden & Son have launched a fine sailing ship for Messrs. Marshall, MacVicar & Co., of Liverpool; she is one of the largest sailing ships ever constructed in any yard on the river; we think we are even justified in saying that she is the largest sailing vessel afloat.

There are no fresh orders for steamers to report, although one large order for Liverpool owners has gone to the London and Glasgow Shipbuilding and Engineering Company, Limited, Govan. This vessel will be of very large carrying capacity, her dimensions being, length, 400 ft.; breadth, 45 ft.; and depth, 32 ft. It is expected she will lift a cargo of nearly 6,000 tons deadweight. The engine shops continue fairly busy, the continued tripling of the engines of old steamers providing plenty of employment, irrespective of engine orders for new steamers. The trial trip of the *Theresina* took place on the 20th instant. This steamer belongs to Messrs. Robert Singlehurst & Company, of Liverpool, and sails in their well-known Red Cross Line. In addition to converting her engines to triple-expansion from compound, large alterations have been effected in the hull, a new topgallant forecastle having been erected, containing full accommodation for firemen and sailors. During the trial trip, the engines worked very satisfactorily, and a mean speed of 11 knots was attained. Her cylinders are 19, 30, and 48 in. diameter, with a stroke of 30 in., and indicated 750 H.P. The work has been carried out by Messrs. David Rollo & Sons, who have recently built several pairs of engines for the same firm. Messrs. Laird Brothers have just completed large alterations to the steamer *Duchess of Sutherland*, belonging to the London and North-Western Railway Company, and employed by them in their cross Channel cattle trade. The vessel was built as a paddle steamer in 1869, and she has just been converted into a twin-screw steamer with triple-expansion engines. The cylinders of each set of engines are 16½ in., 26 in., and 41 in. diameter, with a stroke of 2 ft. 6 in. She has two double-ended cylindrical steel boilers, the working pressure of which is 150 lbs. During the trial trip the engines developed 1,400 H.P., and a speed of 14½ knots was attained. The results of the alteration are worthy of attention, and may be summed up as follows:—The carrying power of the vessel has been increased by about 190 tons, large additional deck space for cattle gained, whilst the nett register tonnage has been reduced by 247 tons. The speed has been considerably increased, whilst the consumption of coal has been reduced 60 per cent. Thus the difference between the old paddle engines and the modern triple-expansion engines has been most strikingly demonstrated, and serves to illustrate the vast strides that engineering has made during the last twenty years.

The last scene in a nautical tragedy will shortly be enacted. The famous but unfortunate *Great Eastern* arrived in the Mersey on the 25th August for the purpose of being broken up. She has done some good work in the past, but her career altogether must be pronounced as one grand failure.

The freight market continues good, business in some quarters being exceedingly good. From the Black Sea rates are higher now than they have been for some years past, and it is quite expected that if the present bad weather continues, with the consequent effect on the grain market, that much higher figures will be current. American cotton freights are good and improving, and as there are very few boats fixed so far, there is no reason to fear any fall. India continues to be the weak spot on the map: although outward rates are good the homeward business considerably neutralises the improvement, the net result of the voyage not being so satisfactory as the others we have named. It looks now as if the "tramp" is in for good times, but the pugnacious liners, we fear, will not get their full share of the revival until the commercial millennium arrives, when managers will be content to live and let live.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—ENGLISH.

Excelsior.—On July 23rd, Messrs. Thomas Turnbull and Son launched from their Whitehall dockyard, Whitby, an iron screw steamship, named the *Excelsior*, built to the order of Messrs. H. Baxter and Co., of that port. The dimensions of the new vessel are as follows:—Length over all, 268 ft. 9 in; length between perpendiculars, 258 ft; breadth, 37 ft.; depth to top of floor plate, 18 ft. 1 in.; class 100 A 1 at Lloyd's; deadweight capacity about 2,600 tons at 18 ft.; bridge, 112 ft. with lodgings for officers and crew under it; raised quarter deck, 60 ft. long; poop aft 28 ft. in length; six water-tight bulkheads of steel; Emerson and Walker's patent windlass, four steam winches, two of 6-in. cylinders and two of 7-in. cylinders; Rogers' steam steering gear; screw steering gear aft; companions and skylights of iron; schooner rigged. Her engines are by Messrs. Blair and Co., Stockton.

and are as follows:—Direct acting triple expansive; diameter of cylinders, 20, 33 and 54 in.; stroke 36 in; nominal h.p. 140; two cylindrical tubular boilers of steel with Fox's patent corrugated furnaces; working pressure 160 lb.

Scottish Lochs.—On July 23rd there was launched from the shipbuilding and engineering works of Messrs. Oswald, Mordaunt and Co., Southampton, an iron sailing vessel of about 2,600 tons register, built to the order of Messrs. W. H. Ross and Co., Liverpool, and of the following dimensions:—Length, register, about 310 feet; breadth, 42 ft. 3 in.; depth, 24 ft. 11 in. The vessel is full rigged with three masts, and is built in excess of the highest class at Lloyd's. She has a long full poop for the accommodation of captain and officers, two large deck houses for petty officers and seamen. In after end of deck-house will be fitted a large winch, boiler, and steam winch, affording great facilities for the rapid loading and discharging of cargo. She is fitted with Harfield's patent combined capstan windlass for working anchors and chains, and anchor crane on forecastle head. This is the fourth vessel built by Messrs. Oswald, Mordaunt and Co. for the same owners, and they have all been built under the superintendence of Captain J. Hamilton, marine superintendent to Messrs. W. H. Ross & Co. On leaving the ways the vessel was named the *Scottish Lochs* by Miss Irene M. A. Steel.

Amy Gordon.—On July 24th there was launched from the shipbuilding yard of Messrs. Wm. Pickersgill and Sons, Southwick, Sunderland, a steel spar-deck steamer, with clipper stem, of the following dimensions:—Length over all 296 ft.; breadth. extreme, 39 ft.; depth, moulded 28 ft. 9 in. She has been built to the order of Mr. F. Gordon, of Sunderland, to the highest classification of Lloyd's having accommodation aft for captain and officers, the engineers being berthed under the spar deck amidships and the crew forward. The water ballast is fore and aft, on the celullar double bottom principle, and she has web frames, thus dispensing with the hold beams. She is fitted with six steel divisional bulkheads, four vertical steam winches by Messrs. Rodgers and Co. of Stockton, patent windlass by Messrs. Emerson, Walker and Thompson Brothers, of Gateshead, and steam steering gear amidships by Messrs. Davis and Co., of London, and she is fitted up with all the latest improvements. The engines will be supplied by Messrs. Black, Hawthorne and Co., of Gateshead, on the triple-expansion principle. As the vessel left the ways she was named the *Amy Gordon*, after the daughter of the owner, by Miss Gordon.

Glen Caladh Tower.—On July 24th there was launched from the shipyard of Messrs. Robert Stephenson & Co. (Limited), at Hebburn, a steel screw-steamer of the following dimensions:—Length, 350 ft.; breadth, 43 ft.; depth, 29 ft. 5 in. The vessel has been built to the three-deck rule, and will take the highest class at Lloyd's for hull and machinery. She has a large cargo poop, long bridge, with accommodation for captain, officers, and engineers, and a few passengers, and there is a topgallant forecastle, with quarters for the crew. The general arrangement of the ship is such that she can be readily adapted for the passenger trade. All the decks and other fittings are of the most approved description. There are four large steam winches by Messrs. Clark, Chapman, Parsons & Co.; a steam windlass, by Messrs. Emerson, Walker & Thompson Bros. (Limited); and one of Higginson's steam quartermasters is placed in the wheelhouse amidships. The vessel has been built to the order of Messrs. F. Stumore & Co., of London and Liverpool, and will join their Tower Line fleet of steamers. She will carry considerably over 5,000 tons deadweight, and will be propelled by triple-expansion engines of the latest design, capable of indicating about 1,800 H.P. The engines and boilers have been constructed by Messrs. R. Stephenson & Co. (Limited) at their Newcastle works. The construction of the vessel and her machinery has been overlooked by Mr. H. C. Ashlin, of London, and Captain M'Nabb, superintendent of the Tower Line. As the vessel left the ways the christening ceremony was performed by Mrs. Robert Stephenson, the vessel being named the *Glen Caladh Tower*, after the Highland residence of Mr. George Robert Stephenson, chairman of the company.

Felbridge.—On July 25th there was launched from the shipbuilding yard of Messrs. C. S. Swan & Hunter, Wallsend-on-Tyne, the *Felbridge*, a steel screw-steamer built for Messrs. W. R. Price & Co., London. The dimensions are:—Length, 280 ft.; beam, 37 ft. 6 in.; depth, moulded, 21 ft. 8 in. The engines are on the triple-expansion principle, supplied by Messrs. the Wallsend Slipway and Engineering Company, and are capable of indicating about 1,000 H.P.

Beatrice.—On July 25th Messrs. Bartram, Haswell & Co. launched from their shipbuilding-yard, South Dock, Sunderland, a steel screw-steamer built to the order of Messrs. Charles Howard & Son, London. The dimensions are as follows:—Length over all, 300 ft.; breadth, 39 ft.; depth, 18 ft. 6 in.; with a gross registered tonnage of 2,150. She has been built under special survey to class 100 A1, being the highest class obtainable at L'oyd's, and has been fitted up with all the latest improvements. The engines, which have been made by Mr. John Dickinson, are of the triple-expansion type of 200 N.H.P., with two steel boilers, to work at 150 lb. pressure, and will propel the vessel at a good rate of speed upon a small consumptlon of coal. She is fitted with a complete double bottom of steel, constructed on the cellular principle, capable of containing 450 tons of water ballast, and divided into tanks for trimming purposes. Accommodation is provided amidships for the captain, officers, and a few passengers. The engineers have quarters under the after end of the bridge-deck, and the sailors and firemen are berthed in a topgallant forecastle. She has Davis & Co.'s patent combined hand and steam steering gear in a teak house amidships, Napier's direct-acting steam windlass, four steam winches, and extra large donkey boiler by Messrs. Clarke, Chapman & Parsons, and special care has been taken to arrange the bulkheads and hatches for safe and expeditious loading and discharging. She was named the *Beatrice* by Mrs. Ritson. The vessel was then towed away to Palmer's Hill Engine Works to have her machinery fitted on board.

Ruysdael.—On July 26th, Messrs. Joseph L. Thompson & Sons launched from their North Sands Shipbuilding Yard at Sunderland a steel steamer of 3,000 tons dead-weight, built to the order of Messrs. Bolton & Kenneth, of London. The vessel is of the most improved type of the well-deck and web-frame system of construction, having engines of the triple-expansion type, with three cranks, and 900 H. P., which are being built by Mr. John Dickinson, of Palmer's Hill Engine Works. Direct steam windlass, steam steering gear, horizontal steam winches, and Wastney Smith's patent stockless anchors will be fitted. The naming of the vessel—*Ruysdael*—was performed by Miss E. M. Glover, of London.

Santurge.—On July 26th there was launched from the Howdon yard of Messrs. Palmer & Co.'s Shipbuilding and Iron Company (Limited), a two-masted schooner of the following dimensions:—Length, 290 ft.; breadth, 40 ft.; moulded depth, 21 ft. 4 in. The vessel is fitted with a long-raised quarterdeck, extending to after end of bridge; and a long bridge amidships, extending over engine and boiler space, with accommodation for captain, officers, and engineers, the crew being provided for in the topgallant forecastle. All the decks are made of iron, and there are five watertight bulkheads; water ballast under machine space and in deep tanks, which can also be used for cargo; Clarke Chapman's steam windlass; Bow M'Lauchlan's steam steering gear; steam winches by Clarke, Chapman; and Price's patent self-trimming hatches. The vessel is built of steel to class 100 A 1 at Lloyd's, aud she will load about 3,300 tons, and attain a speed of ten knots an hour. The engines have also been constructed by the Palmer Company, and are of the triple expansion type, with steel boilers and all the latest improvements. The owners of the vessel are Murieta & Co., of Bilbao and London. As she left the ways the schooner was named the *Santurge*, the ceremony being performed by the wife of the Spanish Consul at Newcastle. It may be added that this is the first vessel that has been launched from the Howdon yard since it was re-opened in March last, after having been closed since 1884, owing to the depression in shipbuilding.

Pigmy.—On July 27th, the first-class gunboat *Pigmy* was launched at Sheerness, the ceremony of naming being performed by Miss Fane, daughter of Capt. C. G. Fane, superintendent of the dockyard. The *Pigmy* is a gunboat of a new type, designed by Mr. W. H. White, director of naval construction, and is considered to be a great improvement on the *Rattler* class. She is 165 ft. in length, and has a breadth of 30 ft. She draws 10 ft. 9 in. of water forward, and 11 ft. 9 in. aft, and has a displacement of 755 tons. The *Pigmy* is to be fitted with engines of 1,200 H. P., estimated to propel her at a speed of 13½ knots per hour. Six 4-in. steel breachloading guns and two five-barrel Nordenfelt guns will form her equipment. The total cost of the *Pigmy*, when ready for sea, is estimated at £40,712.

Prime Minister.—On July 28th, Messrs. Cook, Welton & Gemmell launched from their yard, at Hull, a screw steamer trawler, built to the order of Mr. R. Simpson, steam trawler owner, of Hull, for the purpose of North Sea fishing. As

the vessel left the ways she was christened the *Prime Minister* by Mrs. R. Simpson. The *Prime Minister's* dimensions are as follows:—Length, 95 ft.; beam, 10 ft. 9 in.; depth of hold, 11 ft.; built of iron, to class 100 A 1 at Lloyd's, under special survey. The engines and boilers are of the latest improvements, and are built by Messrs. C. D. Holmes & Co., engineers, of Hull. The vessel will be fitted with all the latest improvements, under the personal superintendence of Mr. R. Simpson.

Lightship.—On August 7th the first of two composite lightships in course of construction by Messrs. Robert Stephenson and Company, Limited, engineers and shipbuilders, Newcastle and Hebburn, was launched from the company's shipyard at Hebburn. The lightships are being built for the Honourable Corporation of the Trinity House, London. The hulls of the vessels are from the designs of Mr. Frank C. Goodsll, surveyor of shipping to the Trinity House, under whose superintendence they have been constructed. The fog signal machinery and illuminating apparatus is under the direct supervision of Sir J. N. Douglas, F.R.S., the engineer-in-chief to the Trinity House. They are the largest lightvessels yet built for the Trinity House, being 113 ft. long, 23½ ft. wide, and 12 ft. 10 in. deep, and are noteworthy as being the first lightships built on the Tyne for the Elder Brethren of the Trinity House. All the scantlings of the hull are exceptionally heavy, being about three times in excess of the requirements of Lloyd's rules for an ordinary vessel of similar dimensions. The bottom planking is of elm, and the topsides of teak, the stem, sternpost and deadwood are of oak, and the keel and rolling chocks of English elm. There is a very powerful Harfield windlass, worked either by compressed air or steam, with Brown's controllers for operating the cables, and strong winches are fitted on deck for working the lantern. For mooring the vessel mushroom anchors are used, and two spare Baxter's anchors are kept in readiness on platforms on each bow. The lantern slides on a steel mast placed amidships, and mineral oil is used as the illuminant. The vessel has not as yet received her name, as this cannot be done until she is placed at her station.

Portslade.—On August 8th a steel steamer was launched from the yard of Messrs. Robert Thompson and Sons, Southwick, Sunderland, built for Messrs. Stephenson, Clarke & Co., of London, under the personal superintendence of Mr. Tinn. The dimensions are length, B.P. 161 ft. 9 in.; breadth, 29 ft. 9½ in.; depth 13 ft. 10 in.; and she is of the raised quarter deck type with bridge and topgallant forecastle, with the usual accommodation, classed 100 A 1 at Lloyd's and built under special survey, has water ballast throughout holds, large hatchways, large steam winch and hand ditto, direct-acting steam windlass, and steam steering gear, schooner rig, large teak chart and wheel house, three boats, anchor crane, &c. The engines are by the North Eastern Marine Engineering Co., Limited, Sunderland, and are 90 H.P. On the vessel leaving the ways she was named the *Portslade*.

Volturno.—On August 9th Messrs. Richardson, Duck & Co. launched from their building yard a steel screw steamer of the following dimensions, viz.:—Length over all, 307 ft. 4in.; breadth extreme, 40 ft.; depth in hold to tank top, 19 ft. This vessel, which has been built for Messrs. Thomas Wilson, Sons & Co., of Hull, under the personal superintendence of Mr. J. F. Wilkins, the company's surveyor, has a raised quarter deck, long bridge extending to foremast and top-gallant forecastle, and is classed 100 A1 at Lloyd's, under special survey. She has a double bottom on the cellular principle extending all fore and aft, and containing 550 tons of water ballast. She will be fitted with four steam winches by Messrs. Amos & Smith, of Hull; steam steering gear, steam windlass; patent stockless anchors and anchor crane. A special fire-extinguishing arrangement is to be carried to the lower part of all holds and 'tween decks, and there will be special pumping arrangements to ballast tank and holds, deck pumps being worked from the winches as well as by hand. There will be double derricks to each hatch, and all modern improvements for facilitating the loading, discharging, and manœuvring of the vessel. All the sails are of Thompson's hurricane canvas, as usually supplied to the company's steamers in the Atlantic and other trades. The engines are by Messrs. Blair & Co., Limited, Stockton-on-Tees, with cylinders 22½ in., 37 in., and 61 in. by 42 in. stroke. As the vessel was leaving the ways she was gracefully christened the *Volturno* by Miss M. S. Richardson, of the Esplanade, Sunderland, niece of the senior partner in the builders' firm.

Gracia.—On August 9th the Spanish steamer *Gracia*, built and engined by Wigham Richardson & Co., for the Linea de Vapores Serra, was launched from the Neptune Works, Low Walker. The *Gracia* is a steamer 345 ft. between perpendiculars, 40 ft. beam, and 28 ft. depth, and is specially fitted up for the company's service. The model of the ship and all the arrangements, which show many points of originality, are entirely due to the designer, Mr. Gilbert S. Goodwin, of James-street, Liverpool. The ceremony of naming was performed by Miss Hilda Stevenson, the daughter of the member for South Shields.

William Morphy.—On August 9th the Blyth Shipbuilding Company launched from their building-yard at Blyth a screw-steamer, built to the order of the Mediterranean Steam Shipping Company, Limited, of Newcastle-on-Tyne. This vessel, which has been specially constructed for the fruit trade, is of the following dimensions:—Length, 174 ft.; breadth, 26 ft.; depth, 14 ft. 8 in.; has long quarter deck covering engines and boilers, short bridge in which is fitted the accommodation for captain and officers, topgallant forecastle for crew, steam winches by Messrs. R. Roger & Company, of Stockton, and Harfield's patent windlass, &c. Triple-expansion engines of good power will be put on board by Messrs. Ernest Scott & Company, of Newcastle-on-Tyne. The vessel has been built under the special survey of Lloyd's, and Captain Haun, who will command the vessel, has superintended her building on behalf of the owners. As the vessel left the ways she was named the *William Morphy* by Mrs. Lenn, of Newcastle-on-Tyne.

Verulam.—On August 9th there was launched from the shipbuilding yard of Messrs. S. P. Austin & Son, Sunderland, a steel screw-steamer of about 1,300 tons gross register, constructed under special survey, to class 100 A1 at Lloyd's, and designed specially to carry a large deadweight cargo on a light draught of water, combined with good speed. The machinery, in the latest improved style of triple-compound, will be supplied by the North-Eastern Marine Engineering Company (Limited), to work at 160 lb. pressure. The vessel was named *Verulam* by Miss Maughan, of Ealing.

Ohio.—On August 9th there was launched from the Deptford yard, Sunderland, the first of two steel steamships being built by Mr. James Laing to the order of the Neptune Steam Navigation Company (Limited), of which Messrs. W. and T. W. Pinkney are managers. This vessel has been specially built for services on the Company's Neptune line between Baltimore and Rotterdam, and is of the following dimensions:—Length, 311 ft.; breadth, 38 ft. 4 in.; and depth, 27 ft. 3 in. She is a spar-deck vessel, with two iron decks, laid upper deck, sheathed with wood, and water ballast in cellular bottom, fore and aft. The saloon and captain's cabin are on the upper deck aft. A long bridge over the engine-room contains cabins for the officers, and the crew are located in the topgallant forecastle. She will be fitted with special appliances for ready working of general cargoes, having two steam winches and double derricks to her hatchways, and an extra large horizontal multitubular boiler on the main deck for working same, also with Emerson, Walker & Co.'s patent direct-acting steam windlass, and Donkin & Nicol's patent steam-steering gear. She is built under special survey to class 100 A1 at Lloyd's, and has a deadweight capacity of 3,600 tons. Her engines, being built by Mr. George Clark, of Southwick, are tri-compound, and of the following particulars:—Cylinders, 22 in., 36½ in., and 60 in., with 39 in. stroke, and are to indicate 1,100 H.P. They will be supplied with extra large steel boilers of 150 lbs. working pressure, with steam starting and reversing gear, patent marine governors, &c. As the ship left the ways she was named *Ohio* by Mrs. Vickerman, of Huddersfield, the wife of the chairman of the Neptune Company.

The Staffa.—On August 9th Messrs. Cochrane, Cooper and Schofield launched from their shipyard at Grovehill a handsome steam trawler, which is the third they have built for Messrs. Pickering & Haldane, of Hull, fishing-smack owners. The vessel, which is of iron, and classed 100 A1 at Lloyd's, was named the *Staffa* by Mrs. Dunn, of the Grovehill Mills.

Gulf of Guinea.—On August 11th there was launched from the shipbuilding yard of Messrs. R. & W. Hawthorn, Leslie and Company, Limited, a steel screw-steamer of the following dimensions:—Length, 330 ft.; breadth, 40 ft.; depth, 25 ft. The vessel has long poop bridge and topgallant forecastle. She has cellular double bottom for water ballast, and is built of Siemens-Martin steel, to class 100 A1 at Lloyd's, and to pass the Board of Trade for passenger certificate. The decks have been built exceptionally high for carrying emigrants or troops. The vessel is brig-rigged, with steel masts. This is the second of the four vessels building by Messrs. Hawthorn, Leslie & Co., for

the Greenock Steamship Company, of Greenock, for their Gulf line of steamers, and is intended for their South American trade. She has been built under the immediate inspection of Mr. Headlam, the superintendent of the owners, and will be fitted with steam steering gear, steam windlass, and all the latest improvements. The vessel was named the *Gulf of Guinea* by Miss Coote, in the presence of a large company.

Cranford.—On August 10th Messrs. W. Gray & Co. launched a fine steel screw-steamer of the following dimensions, viz.:—300 feet in length overall, 38 feet beam, and 22 feet 2 inches in depth, moulded, built to the order of Messrs. Pyman Bros., London. The vessel takes Lloyd's highest class, and has a large carrying capacity. She is of the improved well-decked type, having the bridge extra strong and extending forward to the fore hatch. The poop aft contains a handsome saloon, and accommodation for officers and a few passengers. Comfortable quarters are provided for the crew in the fore part of the bridge. Emerson, Walker and Co.'s patent windlass is fitted forward. The hull is built with web frames, giving strong sides, dispensing with hold beams, and permitting the most bulky description of goods being easily stowed in the holds. A cellular double bottom is fitted for water ballast throughout, five hatches, two donkey boilers, four steam winches, and steam-steering gear are fitted, and the ship is thoroughly equipped as a general trader. The engines are of the triple expansion type of 1,100 horse-power, working on three cranks; they are supplied by the Central Marine Engineering Company, West Hartlepool; the cylinders are 23 inches, 36½ inches, and 62 inches diameter, and the piston stroke 39 inches. The boilers, built of steel, are of large size, and will give an ample supply of steam at a working pressure of 160 lbs. per square inch. The vessel has been superintended during construction by Captain J. Pyman, on behalf of the owners. The christening ceremony was gracefully performed by Miss Winifred Pyman, daughter of Mr. George Pyman, junior, West Hartlepool, the vessel being named *Cranford*.

Buckingham.—On August 11th, Messrs. Thomas Royden and Sons launched from their building yard, Queen's Dock, a large steel ship, 2,600 tons register, built to the order of Messrs. Macvicar, Marshall & Co., of this city. The dimensions of the ship are:—Length, 306 ft.; beam, 45 ft.; depth, 24 ft.; her carrying capacity being estimated at 4,000 tons, on a mean draught of 21 ft. 8 in. Her fore and main lower yards are 90 ft., and she is to be fitted with four masts, three of which are to be square rigged, and with powerful capstan windlass by Emerson, Walker & Co., Limited. As the vessel left the ways she was named the *Buckingham*, the usual ceremony being performed in a very happy style by Mrs. White, of Oldham, who cut the rope, and Miss Kennedy, who gracefully broke the traditional bottle against the bows of the noble ship, which, we understand, is the largest sailing ship ever built on the Mersey, and will be a magnificent addition to the already fine fleet owned and managed by Messrs. Macvicar, Marshall & Co. The company were afterwards entertained to a luncheon in the moulding-room, when appropriate speeches were made by Mr. Groson, Mr. Macvicar, and Mr. T. B. Royden, M.P.

Medusa.—On August 11th another important addition was made to the effective ships of the Royal Navy by the launch from Chatham Dockyard of the twin protected cruiser *Medusa*, one of a valuable class of heavily armed swift steaming cruisers, several of which are either in progress or completed at the Royal dockyards. The *Medusa* is a sister ship to the *Medea*, launched at Chatham some few weeks since, and has an extreme length between perpendiculars of 265 ft., with a breadth of beam of 41 ft.; her mean average draught is 16¼ ft., and her displacenent 2,800 tons. With machinery of 9,000 H.P. she will steam, with all her weights on board, 20 knots. The ceremony of christening the *Medusa* was performed by Mrs. Hole, the wife of the Dean of Rochester. The vessel is to be completed in her internal fittings forthwith, and prepared for being commissioned.

Portichol.—On August 11th, Messrs. Newall & Co., of St. Philip's Ironworks, Bristol, launched the *Portichol* steamer. She measures 102 ft. over all by 18 ft. beam by 8 ft. 6 in. depth of hold. She is built of steel throughout under Lloyd's survey, and is fitted as a twin screw steamer with two pairs of compound surface-condensing engines of 400 H.P. She is built for foreign owners, under the superintendence of Messrs. J. B. Cameron & Co., Glasgow, and is intended for passenger and towing service on the River Plate. She is built, engined, and fitted out complete by Messrs. Newall & Co.

Citta di Roma.—On August 14th at the shipbuilding yard of Messrs. C. S. Swan & Hunter, Wallsend, a steel screw steamer of the following dimensions was launched:—Length, 293 ft.; breadth, 36 ft.; depth, moulded, 25 ft. 5 in. The vessel, which is classed 100 A1 at Lloyd's, and has been built under special survey, has a full poop, long bridge, and topgallant forecastle. She is provided with water ballast, four steam winches for the rapid discharge of cargo, large donkey boiler, steam steering gear, and patent windlass. The saloon, together with accommodation for the passengers and officers, is amidships. Her engines, which are of the triple-expansion surface condensing type, have been built by the Wallsend Slipway Company, and are capable of indicating 1,100 H.P. The vessel is owned by Messrs. G. B. Gastaldi & Co., of Genoa. She was named the *Citta di Roma* by Miss Hunter, daughter of the builder.

Sophie.—On August 18th, Messrs. Armstrong, Mitchell & Co. launched from the Low Walker Shipbuilding Yard a steel tank steamer for the carriage of petroleum in bulk, and capable of carrying 2,100 tons all told. The vessel, which is named the *Sophie*, is intended to trade principally between Batoum and the Mediterranean ports, and has been built for account of foreign owners. The same builders recently despatched a new steel tank steamer, named the *Orelgönne*, of 3,800 tons gross carrying capacity, and intended to trade between the United States and Germany; and they will this week launch another vessel of 4,000 tons burthen for the same trade. The whole of these vessels are subdivided and arranged with Swan's patent expansion trunks, which arrangement allows of vessels being very easily adapted for carrying ordinary cargoes, and also provides easily worked bunker accommodation for the outward and homeward journeys. The vessels are fitted with very complete installations for loading and discharging, the oil pumps being of the Worthington description. They have also steam heating and steam cooking arrangements, and are fitted throughout with electric light. Armstrong, Mitchell & Co. have made this class of vessel quite a speciality, and have built a large number, which are running with complete success, and they have several others of the same description under construction at the present time.

Tangier.—On August 21st this vessel was successfully launched from the yard of Messrs. W. Doxford and Sons, at Pallion. She has been sold to the Angier Line (1887), Limited, and is entirely of steel, built to Lloyds 100 A 1 class. The principal dimensions are:—Length between perpendiculars, 263 ft.; breadth, 37 ft.; depth, 18 ft. 6 in., with cellular bottom fore and aft. The engines are triple expansion three cranks, with all Messrs Doxford's latest improvements, the cylinders being 21 in., 33 in., and 54 in. diameter respectively, and the stroke 36 in., and they are supplied with high-pressure steam from exceptionally large boilers. She is fitted with McLachlan's patent steam steering gear and Hastie's screw gear aft, and four winches, 7 in. by 10 in., by Messrs. Weyland Brothers, of Pallion, with all the most recent improvements for cargo purposes. The cabins are most tastefully constructed in hardwood in the poop aft, and give most comfortable quarters for captain and officers, engineers being berthed in bridge-house abaft engine-room. The crew and firemen have exceptionally large and comfortable quarters in front of bridge-house. The vessel is a duplicate of the s.s. *Chamois*, recently built for Messrs. Jackson Brothers and Company, of London.

New Borough.—On August 22nd, Messrs. W. Gray & Co. launched a fine steel screw steamer of the following dimensions:—Length overall 270 ft.; breadth, 36 ft. 6 in.; depth, 19 ft. 5 in.; built to the order of Christopher Furness, Esq., West Hartlepool. The vessel has a large carrying capacity, and takes Lloyd's highest class. She is of the well-decked type, with a long raised quarter deck, having saloon and cabins for officers and a few passengers aft, and a long bridge of extra strength carried right to the fore hatch, and containing comfortable quarters for the crew. The usual topgallant forecastle is fitted forward with Emerson, Walker & Co.'s windlass. The hull is built on the web frame principle, dispensing with hold beams, and giving a clear hold for working cargo. Five hatchways are fitted, four steam winches, steam steering gear, donkey boiler, and double bottom under each hold for water ballast. The boats are carried on beams overhead, and a complete equipment is provided for general trading. Fine triple-expansion engines, having cylinders 19 in., 30½ in., and 51 in. diameter, with a 36 in. stroke of piston, giving 700 H.P., and two steel boilers to work at 150 lbs. pressure per square inch are being supplied by the Central Marine Engineering Co., West Hartlepool. She was gracefully christened *New Borough* by Mrs. Farmer, daughter of the Mayor of West Hartlepool. This is the eleventh steamer built by Messrs. W. Gray and Co. for the same firm. We may add that the hull

and machinery of the *New Borough* have been built under the superintendence of Capt. T. King and Mr. C. E. Booth, respectively.

LAUNCHES.—Scotch.

Sir Francis Drake.—On July 24th, a new steamer built for the Sir Francis Drake Steamship Company, Limited, of Plymouth, was launched at Grangemouth. She has been constructed of steel by the Grangemouth Dockyard Company, under Lloyd's special survey, for the 100 A 1 class, and will be engined by Messrs. Ross and Duncan, of Glasgow, with triple-expansion engines of good power. The vessel has a long, raised quarter-deck, extending to the foremast; topgallant forecastle, and cellular double-bottom for water ballast. She is to be fitted with shifting boards and high coomings to meet the requirements of the Grain Cargoes' Act; also four powerful steam-winches, one to each hatchway, steam-steering and starting gear, and all the latest improvements. Her dimensions are—260 feet long, 36 ft. beam, 19.5 moulded depth. On leaving the ways the steamer was named the *Sir Francis Drake*, by Miss Kate Triplett.

Robert Rickmers.—On July 25th, Messrs. Russell and Co., shipbuilders, launched from their shipbuilding yard at Greenock a four-mast iron sailing ship of 2,000 tons, and of the following dimensions: — Length, 280 ft.; breadth, 42 ft.; and depth, 24 ft. 6 in. The vessel, which is barque-rigged, has a carrying capacity of 3,500 tons, and has been built to the order of Mr. R. C. Rickmers, of Bremerhaven, for whom Messrs. Russell and Co. have constructed several ships. On leaving the ways the vessel was named the *Robert Rickmers* by Mrs. Gennerich, wife of the commander of the ship. The vessel is to be fitted out for sea at Greenock, after which she will load 3,000 tons of coal at the James Watt Dock for Rangoon.

Buteshire.—On July 26th Messrs. Birrell, Stenhouse & Co. launched from their shipbuilding yard at Dumbarton a four-masted steel sailing ship of 1,900 tons register for Messrs. Thos. Law & Co., Glasgow. She is of the following dimensions:—Length, 270 ft.; breadth, 40 ft.; depth, 24 ft. She has been built under special survey to Lloyd's highest class. She was named *Buteshire* by Miss Howie, and forms an addition to the "Shire" Line. Her patent capstan windlass is by Emerson, Walker and Co. When completed the vessel will load for Australia, under command of Captain M'Gibbon, late of the *Agnes Oswald*.

Klio.—On July 26th Messrs. Charles Connell & Co. launched from their Scotstoun shipbuilding yard a steel sailing ship of 1,650 tons register for foreign owners. She is fitted up with all the most recent improvements, and as she left the ways was named *Klio* in the customary manner by the wife of Captain Bramslow, who takes command of the vessel.

Tinto Hall.—On July 26th Messrs. Russell & Co. launched from their Kingston Yard, Port Glasgow, a four-masted sailing barque, named *Tinto Hall*, to the order of Messrs. R. W. Dickson and Co., Glasgow. This vessel is a sister ship to the *Loudon Hall*, built about a year ago by Messrs. Russell & Co. for the same owners. Her dimensions are:—Length, 283 ft.; breadth, 40 ft.; depth of hold, 24 ft. 6 in. She is 2,080 tons net. register, and has been supplied with a donkey boiler and steam winch in the forward deck-house, besides having all the other most modern appliances for loading and discharging cargoes. This vessel was built under the superintendence of Captain Hall, formerly of the *Loudon Hall*, and he will take command of the new vessel, which will fit out in the James Watt Dock, Greenock, and afterwards loads at Glasgow.

Lord Rosebery.—On July 27th Messrs. Russell & Co. launched from their east end yard at Port Glasgow a steel screw steamer of 1,296 tons gross register, named *Lord Rosebery*, for Messrs. J. and A. Wyllie, shipowners, Troon. Her dimensions are:—Length, 231 ft. 3 in.; breadth, 33 ft.; depth of hold, 17 ft. This vessel will have a carrying capacity of 1,700 tons on moderate draught. After the launch she was towed to Greenock to be supplied with her machinery, which is on the triple-expansion principle, by Messrs. Kincaid & Co.

Viera y Clavijo.—On July 27th Messrs. David J. Dunlop and Co., engineers and shipbuilders, Inch Works, Port Glasgow, launched from their yard a steel screw steamer of the following dimensions:—Length between perpendiculars, 190 ft.; breadth moulded, 27 ft.; depth of hold, 13 ft., or 20 ft. to the shade deck. The vessel has been built to the order of Messrs. Elder, Dempster and Co., of Liverpool, for the Compania de Vapores Correos Interinsulares Canarios, and is the second of several steamers for the mail service round and among the Canary Islands. While being classed 100 A at Lloyd's, and built under special survey with all Board of Trade requirements for foreign-going passenger service, the steamer is fitted with electric light and all the most modern appliances for the comfort of first and second class passengers, of which she carries a large number. The machinery, which is by the builders, is of the triple-expansion type, of large power. As the vessel left the ways she was named the *Viera y Clavijo* by Miss Lola Steven, daughter of Mr. James Steven, of London. This vessel is a sister ship to the *Leon y Castillo*, launched from Inch Works on the 15th June last.

Halifax.—On July 27th, at Govan, there was launched by the London and Glasgow Engineering and Shipbuilding Company, a cargo and passenger steamer, the *Halifax*, built to the order of the Canada Atlantic Steamship Company of Halifax, Novia Scotia, for their Charlottetown, Halifax, and Boston passenger service. She is a steel screw steamer of about 1,600 tons gross register, having been built under special survey of Lloyd's and Board of Trade. The vessel has been specially designed for the trade intended, and combines large carrying capacity, with a guaranteed speed of 15 knots an hour. She is to be commanded by Captain S. R. Hill, of Halifax, N.S., under whose superintendence she was specially designed and built. Accommodation has been provided for 350 first-class passengers. A thorough system of ventilation is provided, and the incandescent electric light is fitted in every part of the ship, even to engine-room, tunnel, and stokehole. There are three decks, consisting of main, spar, and shade, &c.; the latter extends from taffrail forward to within 20 ft. of stem, forming a spacious promenade for passengers; on same deck is a large smoking-room amidships over saloon and pilot house forward, in which there is accommodation for captain and officers. The accommodation for engineers, petty officers, firemen, and seamen is arranged amidships, together with gallery, pantry, bar, ice-house, and other usual fittings for a first-class passenger steamer. Under the spar deck forward is accommodation for 50 second-class passengers. She is fitted with steam-heating apparatus throughout, steam-steering gear aft, worked from pilot-house with connecting steel rods; steam winches at each of the three hatches, steam warping capstan aft, steam windlass and capstan forward. On maindeck are ladies' cabin, state-rooms, and sleeping-berth to accommodate 175 first-class passengers. The vessel has water-tight bulkheads, water-ballast, and double bottom, double plates, and superior strength in bows to withstand shocks from ice or other collision, and all the most recent approved appliances for safety and comfort. Her engines are of the most modern improved type, supplied by the builders, being triple expansion, to indicate about 2,800 H.P., and it is confidently expected that a high rate of speed will be attained. The *Halifax*, on leaving the ways, was named by Miss Bessie Forsyth, daughter of Mr. George E. Forsyth, of Halifax, Nova Scotia, one of the directors of the company. The steamer will shortly go on berth to receive cargo for Halifax direct.

Chow Fa.—On July 31st there was launched by the Fairfield Shipbuilding and Engineering Company (Limited), from their yard at Govan, a steel screw steamer of about 1,650 tons gross for the Scottish Oriental Steamship Company (Limited), for their service on the China coast. The dimensions of the steamer are as follows:—Length, 270 feet; breadth, 36·9 feet; depth, 22·9 feet. She is built according to the three-deck rule to class with Veritas. The steamer has a straight stem and an elliptic stern, with a turtle back forward and deckhouse on upper deck for officers and passengers. The vessel will be fitted by the Fairfield Company with a set of their triple-expansion engines, with three inverted cylinders direct acting with surface condenser; h.p. cylinder, 22 inches; intermediate, 36 inches; and low, 57 inches; by 3 feet 6 inches stroke. Steam will be supplied by two cylindrical tubular boilers with three corrugated furnaces in each, and adapted for a working pressure of 150 lb. The steamer is fitted with all the latest improvements for the comfort of passengers and working of cargo, to pass Board of Trade and Bureau Veritas surveyors. On leaving the ways she was named the *Chow Fa* by Mrs. Sowter, of Gravesend.

Barry.—On August 8th, there was launched from the shipbuilding yard of Messrs. Wm. Simons and Co., Renfrew, the screw-propelling, barge-loading dredger *Barry*, constructed to the order of Mr. T. A. Walker, contractor for the Manchester Ship Canal. The bucket ladder is adapted to work in a central well to a depth of 26 feet under water level, and it will have a raising capacity of 300 tons of *débris* per hour. The engines,

which are also constructed by the builders, are of the compound surface condensing type. As is the usual practice of the builders, this vessel was launched with its engines, boilers, and dredging machinery on board. It will be engaged dredging in Barry Docks, Cardiff, for a short time, after which it will proceed to the Manchester Ship Canal. The *Barry* was built under the direction of Mr. J. H. Simpson.

Pass of Balmaha.—On August 9th Messrs. Robert Duncan and Co., shipbuilders, launched from their yard at Port Glasgow a steel sailing ship of 1,500 tons net. register and the following dimensions:—Length, 235 ft.; breadth, 38 ft. 9 in.; depth of hold, 22 ft. This vessel has been built to the highest class at Lloyd's, is fitted with all the latest improvements, including Hastie's patent winches for facility in working the ship. She is built to the order of Messrs. Gibson & Clark, Glasgow, for the general trade between this country and San Francisco. On leaving the ways she was named *Pass of Balmaha* by Miss Miller, of Pollokshields.

Ravenna.—On August 9th Messrs. Ramage & Ferguson, shipbuilders, Leith, launched from their yard a steel screw steamer of 1,230 gross tons, named the *Ravenna*, built to the order of Messrs. Jas. Currie & Co., Leith, for their Baltic trade. The dimensions are:—Length, 249 feet; breadth, 33 ft.; depth 18 ft. (moulded). The steamer will be supplied with triple-expansion engines of 700 H.P. indicated, and cylinders 18 in., 30 in., and 48 in. diameter, and 36 in. stroke. The ceremony of naming was performed by Miss Georgeson, of South Africa. The *Ravenna* is a sister vessel to the *Ancona*, lately launched from the same yard for Messrs. Currie.

William Cliff.—On August 9th, there was launched from the shipyard of Messrs. Barclay, Curle, and Co., Limited, Whiteinch, Glasgow, a steel screw steamship of about 3,400 tons gross register, built to the order of the West India and Pacific Steamship Company, Limited, of Liverpool, and intended to trade between Liverpool and West India and Mexican ports and New Orleans. Cabin accommodation is provided in midship deckhouse, which extends the full breadth of the ship, for 50 first-class passengers. The dimensions of the steamer are 370 ft. long, 41 ft. broad, and 27 ft. depth of hold, and she will be provided with all the modern improvements and appliances which the experience of the trade requires. The ship, in addition to the British Board of Trade requirements, is to be fitted as required by the American Passenger Act, and is to be entered on the Admiralty list for transport service. Steam fire-extinguishing pipes are placed in every compartment, and each can be controlled from the deck. The vessel has been named after the chairman of the company, and on moving on the ways was named the *William Cliff* by Mrs. Cliff, of Claremont, West Derby, near Liverpool. After the launch the ship was towed to the harbour to be fitted with her engines, which are to be supplied by the same builders, and are of the triple-expansion type, the boilers being of steel, with Fox's corrugated flues, and will develop a power of 2,500 horses.

Gerona.—On August 9th a steamer, built to the order of Messrs. W. Thomson and Sons, Dundee, was launched from the shipbuilding yard of Messrs. Gourlay Brothers and Co., of Dundee. As she left the ways the vessel was named the *Gerona* by Miss Cooper, niece of the senior partner of the firm. The vessel, which is of steel, has been built under special survey of Lloyd's Registry to class 100 A1. She will be schooner-rigged. Built on the three-deck type; she possesses six water-tight bulkheads, and has a double bottom throughout, on the cellular system, for water ballast. Her length is 345 ft.; breadth, moulded, 43 ft.; and depth of hold, 28 ft. 9 in. The *Gerona* is to be fitted with triple expansion engines of 420 nominal H.P., three cylinders being 29, 44, and 71 in. diameter respectively, and the length of stroke four feet. Steam will be supplied by two multitubular double ended boilers, which will have a working pressure of 160 lbs. per sq. in. The *Gerona* will be about 3,100 tons gross register, and she has been designed to provide the largest carrying accommodation possible for her size, consistent with the development of a good rate of speed. She has four cargo batches and five steam winches, and, in addition to being fitted with steam steering gear, she will be fitted with the most improved machinery for the rapid loading and discharging of cargo. Anchors and Wastney Smith's patent stowing up hawse-pipes. The *Gerona* will be commanded by Captain William Sangster, formerly of the *Dracona*, and will be employed as a general trader.

Orbo.—On the 10th August there was launched from the shipbuilding yard of Messrs. Wm. Hamilton & Co., Port Glasgow, a handsome steel screw steamer of the following dimensions, viz.:—Length, b.p., 265 ft.; breadth, moulded, 37 ft.; depth, ditto, 20 ft. The vessel has long raised quarterdeck, long bridge to foremast, and topgallant forecastle, water ballast throughout on the cellular double-bottom principle, direct steam windlass, Alley and M'Lellan's patent combined hand and steam steering gear, and all the latest modern improvements for despatch in loading and discharging, and will carry 2,600 tons deadweight on a light draught of water. The steamer has been built to the order of Messrs. Strong, Reid & Page, of Liverpool; specially designed for the Mediterranean and Atlantic trades, and will form a valuable addition to their fleet. She will be fitted with triple-expansion engines, having cylinders 21 in., 33 in., and 54 in. diameter by 39 in. stroke, by Mr. William Kemp, Govan. The vessel and machinery have been built under the superintendence of Mr. George Hepburn, consulting engineer, Liverpool, and she will be under the command of Captain T. Hughes. The ceremony of naming the *Orbo* was performed by Mrs. Reid, wife of one of the owners.

Princesse Josephine.—On August 13th Messrs. William Denny and Brothers, shipbuilders, Dumbarton, launched a fine paddle steamer called the *Princesse Josephine*—a sister ship to the *Princess Henriette*, a vessel which has already attracted considerable attention in shipping circles by its fast sailing between Ostend and Dover, where it is plying with the Belgian and English mails. The success achieved by that vessel has brought honour and distinction to the builders and engineers, the principals of both firms having been made Chevaliers of the Order of Leopold. It is anticipated that even better results will be attained by the *Princesse Josephine*.

Ulysses.—On August 13th Messrs. Scott & Co., shipbuilders, Greenock, launched from their yard a fine screw steamer of 2,460 tons for the Ocean Steamship Company, of Liverpool. The new steamer is named *Ulysses*, and is of the following dimensions:—Length, 320 ft.; breadth, 36 ft.; and depth, 27 ft. 9 in. She will be supplied by the builders with triple-expansion engines of 1,300 H.P., with a working pressure of 150 lb. to the square inch.

Victoria.—On August 13th there was launched from the shipbuilding yard of Messrs. William Swan & Co., Kelvin Dock, Maryhill, a finely-modelled screw steamer of the following dimensions:—Length, 75 ft.; breadth, 14 ft.; depth, 8 ft. The engines are compound surface condensing, having cylinders 11 in. and 22 in. by 14 in. stroke, and are being fitted by Messrs. Fisher and Co., of Paisley. The vessel is intended for carrying mails and passengers in the West Indies. As the vessel left the ways she was named the *Victoria* by Miss Swan, of Braeside.

Fore-and-Aft Screw Ferry.—On August 17th there was launched from the shipyard of W. S. Cumming, Blackhill Dock, Glasgow, a steel fore-and-aft screw ferry, which has been built to the order of the Trustees of the Clyde Navigation for their cross-river service. This ferry, which is of the following dimensions—50 ft. by 12 ft. 6 in. by 4 ft. 2 in. mould—is in some respects a departure from the present type. The hull is wholly constructed of steel, while all the woodwork, including deck, rails, seats, &c., is of teak. The steering of the vessel also, which is done by both rudders acting simultaneously, is controlled from a raised platform amidships, and along with the levers for working the engine is under the direct charge of one man. Sparred seats of teak are fitted along both sides of the vessel, and the engine and boiler, hatch, and steering platform are surrounded by a light steel casing 3 ft. high, which renders these parts more secluded than in the present ferries. The engines have also been altered from the diagonal to the vertical marine type, with all the latest improvements; and, in addition to a fire-pump, the vessel is supplied with a full equipment of hose for salvage purposes.

Falls of Inversnaid.—On August 21st Messrs. Russell & Co., shipbuilders, Greenock, launched from their Main Street yard a large steamer to the order of Messrs. Wright & Breakenridge, shipowners, Glasgow, for their well-known "Falls" Line. The vessel is the first steamer of their fleet, and is the ninth vessel built by the Messrs. Russell for this line. On leaving the ways the steamer was named the *Falls of Inversnaid* by the Misses Ross, Govanhill, Glasgow; and among those present were Mr. R. G. Ross, Major Hector Tulloch, and Mr. Clarke, M.I.C.E., of the Local Government Board, Bombay; Mr. H. Nicholson, M.I.M.E., Manchester; Mr. Graham, Liverpool; Mr. Glen, Mr. Henderson, Glasgow; Mr. J. H. Strange, &c. The *Falls of Inversnaid* is a steel screw-steamer of about 2,700 tons gross, and of the following

dimensions:—Length, 312 ft.; breadth, 40½ ft.; depth of hold, 19½ ft. She has been built on the web-frame system, with cellular bottom for about 600 tons water ballast, and is of the well-decked type, with long bridge, quarter-deck poop, and topgallant forecastle. She has been fitted with steam winches for the rapid discharge of cargo, Messrs. Alley & M'Lellan's Sentinel steam steering gear, and Messrs. Clark, Chapman & Co.'s steam windlass. After the launch the vessel was taken into the Victoria Harbour, where she will be fitted with Messrs. Rankin and Blackmore's patent quadruple expansion engines of 167 H.P. (nominal). The boilers will be worked by mild forced draught, and are expected to give economical results. The vessel was built under the supervision of Messrs. Neish & Wilson, consulting engineers, Glasgow. After being fitted out she will load for an Eastern port at Glasgow.

Tacora.—On August 21st Messrs. John Reid & Co. launched from their building-yard at Port Glasgow an iron schooner of 900 tons net register. On leaving the ways the vessel was named *Tacora*, and is built for Messrs. Nicolson & M'Gill, Liverpool. She was, after being launched, taken into Port Glasgow harbour to be fitted out.

Lochiel.—On August 22nd, there was launched from the building yard of Messrs. Murdoch & Murray, Port Glasgow, a large steel screw steamer of the following dimensions, viz.:—279 ft. by 37 ft. 8 in. by 20 ft. 6 in. depth of hold; gross tonnage, 2,100 tons. The vessel has been built to the highest class at Lloyd's under special survey, and has raised quarterdeck, poop, long bridge, and topgallant forecastle, cellular water ballast throughout, Davis's steam steering gear, Napier's steam windlass, and steel masts and yards. She will be a large carrier on a light draught, and is fitted with all the latest improvements for the rapid discharging of cargo. She is also fitted for carrying grain, the hatches being large to act as grain feeders. Particular attention has been given to ventilation throughout the entire ship. The vessel has been built to the order of Messrs. James Gardiner & Co., Glasgow, under the personal supervision of Captain Gibb. As the vessel left the ways she was named the *Lochiel* by Mrs. Gibb, wife of the owner-superintendent, and was then taken in tow for Glasgow, where her machinery, consisting of triple-expansion engines to indicate 1,600 H.P., steam winches, &c., will be supplied by Messrs. Ross & Duncan, engineers, Govan.

Palaspa.—On August 23rd Messrs. A. & J. Inglis, shipbuilders, Pointhouse, launched from their yard there the *Palaspa*, a steel screw steamer of 3,500 tons, for the British India Steam Navigation Company, Limited. Her dimensions are:—Length, 350 ft.; breadth, 42 ft.; and depth, 29½ ft. She will be fitted with triple-expansion engines, having cylinders 27, 45, and 70 in. diameter, with 4½ ft. stroke. Accommodation has been provided for 36 first-class and 25 second-class passengers. Otherwise the vessel will be fitted with all the most improved appliances.

Foohng Suey.—On August 23rd a sailing vessel was launched from the yard of Messrs. Napier, Shanks & Bell, Yoker. She was named the *Foohng Suey* by Mrs. H. M. Napier, Bowling. The vessel is a steel barque, of 1,000 tons net, built for Messrs. Brewer and Company, Limited, of Honolulu, Hawaiian Islands. She is classed 100 A1 at Lloyd's, and is furnished with all modern improvements. While having a large carrying capacity, she is built on fine lines, and it is believed will prove a fast sailor. Among the company present at the launch were Mr. E. M. Brewer, one of the owners; Dr. F. H. Underwood, United States Consul at Glasgow; Miss Underwood, Mr. Barnet Harvey, Mr. H. Loring, Boston; Captain Robertson, of the s.s. *Islander*, Canadian Pacific Navigation Company; Mrs. Napier, Glenarbuck, Bowling; Mr. L. B. Twentyman, Miss Twentyman, Mr. James Fulton, Pollokshields; Mr. Allan and Mr. Bell, of Lochlomond Steamboat Company; Mr. Frederick Newell, Captain Polson, and Rev. Mr. Henderson, Old Kilpatrick. The vessel is to be commanded by Captain A. W. Newell, and will shortly proceed on her maiden voyage to San Francisco. Her Majesty the Queen and suite witnessed the launch from the opposite bank.

Trifels.—On August 24th there was launched from the yard of the Sunderland Shipbuilding Company, Limited, Sunderland, a finely modelled spar-decker screw steamer of the following dimensions and particulars:—Length register, 322 ft.; breadth, 40 ft.; depth of hold to top of ordinary floors, 28 ft. 6 in.; and having a cutwater with a graceful figure-head, representing the Lorelei; tri-compound engines by the North-Eastern Marine Engineering Company Limited, having cylinders 23½ in., 39 in., and 64 in. × 42 in. stroke, and 160 lbs. working pressure. The vessel is built to the highest class in Lloyd's, under special survey, having long bridge amidships for the accommodation of captain and officers and a few first-class passengers, and topgallant forecastle for crew. The vessel is of the cellular double-bottom and web-frame principle, the frames of the vessel being of Z steel, and both main and spar decks of steel, the latter being also covered with a wood deck. She is fitted with all the latest improvements, having four large hatches and five steam winches (by Welford Brothers, of Sunderland), for the rapid loading and discharging of cargo, Harfield's chain underneath, direct steam windlass, and steam steering gear by Messrs. Donkin and Nichol, of Newcastle. The vessel is built to the order of the Hansa Steam Navigation Company, of Bremen, and during construction both hull and machinery have been inspected by Mr. Wolff & Capt. Taree on their behalf. On leaving the ways she was named the *Trifels* by Miss Hands, of Sunderland.

Jesmond.—On August 25th, Messrs. Wood, Skinner & Co., Bill Quay, Newcastle-on-Tyne, launched from their yard an iron screw steamer, built to the order of Messrs. L. S. Carr & Co., Baltic Chambers, Newcastle, her principal dimensions being 110 ft. by 20 ft. by 9 ft., with a deadweight carrying capacity of 230 tons. The vessel has been built under Lloyd's special survey for the 100 A 1 class, and will be fitted with compound engines, 15 in. and 28 in., and 20 in. stroke, the boilers to work to 100 lbs. pressure. She is intended for the coasting trade, and has been specially arranged for carrying heavy machinery. On leaving the ways she was gracefully christened the *Jesmond* by Mrs. T. Robson, and immediately after the launch she was towed to the works of the North-Eastern Marine Engineering Company, Limited, Wallsend, to receive her machinery.

LAUNCH.—Irish.

Kirklands.—On August 23rd there was launched from the shipbuilding works of Messrs. Workman, Clark & Co., Belfast, a steel screw steamer, built for Messrs. James R. Cuthbertson and Co., of Glasgow. This vessel has been built of steel, and when completed will be classed in Lloyd's 100 A1, spar deck. She is fitted with a double cellular bottom all fore and aft, and a trimming tank in the after peak. Her dimensions are—Length between perpendiculars, 271 ft.; breadth, moulded, 37 ft.; depth, moulded, 26 ft. 2 in.; tonnage gross, 1,800; register, 1,145; capacity for deadweight at Lloyd's freeboard, 2,800 tons. The vessel has two laid decks, the main being steel and the spar deck teak. There are also a short bridge-deck and a monkey forecastle. She has four hatches, the midship one being of extra large size. There are four steam winches and cargo derricks, and one derrick for lifting weights up to 10 tons. The windlass is a steam direct, of Emmerson & Walker's patent, and there is steam steering gear on the bridge by Messrs. Bow, M'Lachlan & Co. The ship is rigged as a schooner, with two pole masts of steel, and with square sails on the foremast. Instead of hold beams being fitted, the frames have all been made deeper in the web than Lloyd's rules, which saves the breaking of stowage by the beams. The officers are berthed aft, the engineers amidships, and the crew forward—all being under the spar deck. The accommodation for captain is provided in a house under the bridge-deck. The ceremony of naming was performed by Mrs. George Cuthbertson, of Glasgow, who gave the ship the name of *Kirklands*. During the construction of the vessel she was specially surveyed by Lloyd's surveyor, and also by Mr. M'Nicoll, of Glasgow, on behalf of the owners. The engines for the new steamer are of the triple-expansion type, 1,000 I.H.P. The boiler is double-ended, with three furnaces in each end.

LAUNCH.—German.

Helene Sauber.—On August 4th the Flensburg Shipbuilding Company launched a new steel screw-steamer, *Helene Sauber*. She has the following dimensions:—218 ft. by 31ft. 2 in. by 16 ft. 1 in., and is built at Lloyd's 100 A1, and 1st Div. Veritas. The triple-expansion engine of 650 I.H.P., also built by the Flensburg Shipbuilding Company.

The Fastest Passage from the Cape.—The Union Steamship Company's steamer *Tartar*, Captain H. D. Travers, with the homeward Cape of Good Hope and Natal mails, arrived at Plymouth at 11·5 p.m. on Saturday, August 25th. The length of her passage was 17 days 6 hours 15 minutes, including five hours 23 minutes detention. This is the fastest yet made from the Cape.

TRIAL TRIPS.

Gauthiod.—On July 21st a satisfactory trial trip of the steamer *Gauthiod* took place, this boat having been almost transformed at the Lindberg Engineering Company, Sweden. The *Gauthiod* has been altered from a paddle to a screw steamer, the carrying capacity has been increased from 180 to 200 tons to 500 tons, and the speed (a new triple expansion engine having taken the place of the old one) has been increased from 8½ to 12¼ knots, the consumption of coal having simultaneously been reduced from 32 to 18 cubic feet per hour. This alone means a saving of about £500 per year. The *Gauthiod* is intended to sail between Stockholm and Lübeck, and has accommodation for forty first-class and twenty-two second-class passengers.

Warlburg.—On July 28th a new steel screw-steamer *Warlburg*, built by the Flensburg Shipbuilding Company, made her trial trip. This steamer is built for the Bremer Hansa Company, and is classed in British and German Lloyd's 100 A1. The dimensions are:—270 ft. by 37 ft. 2 in. by 23 ft.; spar deck rule; cabin arrangements on deck in the bridge; the engines on the triple-expansion principle, with forced draught, 1,200 I.H.P., worked to entire satisfaction.

Legislator.—On August 1st the s.s. *Legislator*, built by Messrs. Raylton Dixon & Co., to the order of Messrs. Thos. & Jas. Harrison, of Liverpool, for their Indian trade, being the sixth vessel built by them for this line, left the yard of her builders for her trial trip. Her leading dimensions are:—Length, 341 ft. 6 in.; breadth, 40 ft.; depth, 29 ft. 2 in.; with a carrying capacity of over 4,100 tons. She is built of steel to spar deck rule, with short poop, and "Liverpool" deck-house aft, which contains handsome saloon and accommodation for passengers; long bridge amidships, with officers' rooms underneath, and chart and bridge house on top. Her deck arrangements, with loading and discharging gear, are particularly complete, and one notable feature about her is, that the alleyways and rooms below the bridge, and the floors of the saloon and passenger accommodation, are all laid in cement instead of the usual wooden decks. Her engines, by George Clark, Esq., of Sunderland, have cylinders 24 in., 40 in., and 66 in. and 45 in. stroke, and will indicate 1,700 H.P. The trial trip proved eminently satisfactory, on the termination of which she proceeded on her voyage to Cardiff.

Alexandra.—On August 3rd the new screw-tug *Alexandra*, recently launched by Messrs. M'Knight & Co., Ayr, for the Alexandra Towing Company (Limited), Liverpool, left Ayr to adjust compasses and have speed trials in the Gaerloch. The machinery, which has been supplied by Messrs. Muir & Houston, of Glasgow, is compound surface-condensing, cylinders 21 in. and 42 in. diameter, by 27 in. stroke; steel boiler, 14 ft. diameter by 10 ft. long, 100 lbs. working pressure. The engines worked admirably during a nine hours' trial, indicating 500 H.P.; average speed 10 knots. The new steam-yacht *Tighnamara*, 208 tons, also built by Messrs. S. M'Knight & Co. to the order of Messrs. John Inglis & Co., 254, West George Street, Glasgow, left Ayr on August 4th for official trial of machinery and to adjust compasses preparatory to her being taken over by the owners

Isle of Anglesey.—On August 7th the new screw-steamer *Isle of Anglesey*, built by Messrs. Readhead & Co., West Dock, South Shields, to the order of Captain J. T. Williams, for the Isle of Anglesey Steam Shipping Company, of Liverpool, was taken to sea on her trial trip. The *Isle of Anglesey* is built of steel, the dimensions being:—Length, 230 ft.; breadth, 33½ ft.; depth, 18 ft. She will be classed 100 A 1 at Lloyd's under special survey. The vessel is of the well-decked type, having a long raised quarter-deck, bridge amidships, and topgallant forcastle, and is built on the cellular bottom principle for water ballast. She is fitted with triple-expansion engines, steam being supplied from one large single-ended steel boiler at a pressure of 160 lbs. The results of the trial were in every way satisfactory, the vessel having maintained an average speed of 10 knots. After the trial the steamer proceeded to Tyne Dock to load a cargo of 2,000 tons for Genoa. She will be commanded by Captain Williams, of Liverpool.

Abertay.—On August 9th the *Abertay*, a new screw-steamer, built and engined by Messrs. William Simons & Co., Renfrew, to the order of Messrs. A. & A. Y. Mackay, Grangemouth, and under the superintendence of Mr. J. Donaldson, consulting engineer, after loading a cargo at Queen's Dock, Glasgow, proceeded down the Clyde on its trial trip. It carries 1300 tons deadweight cargo on a light draught, and ran the measured mile at Skelmorlie, when a mean speed of 10¼ miles was attained, a result which is considered very satisfactory both by the owners and the builders. The vessel, which is intended for the Baltic timber and grain trade, afterwards proceeded on its maiden voyage, its destination being Archangel. It has been constructed under Lloyd's special survey to their highest class, the hull being Siemens-Martin's steel, and is fore and aft schooner-rigged. The following are the principal dimensions:—Length, 230 ft.; breadth, 33 ft.; depth, 15 ft. 3 in., having cellular double bottom for water ballast. Instead of 'tween deck beams the sides are stiffened with strong web frames, thus avoiding interference with the good stowage of the cargo. The most recent improvements have been adopted, including Alley & McLellan's patent steering gear on bridge, and Napier Brothers' double screw gear aft, also the same firm's patent capstan and windlass fitted on the topgallant forecastle. For the quick despatch of cargo Messrs. J. H. Wilson & Co.'s horizontal winches are provided at each of the hatches. The engines are on the triple-expansion principle, and of 750 I.H.P., the diameter of the cylinders being 17 in., 27 in., and 44 in. respectively, with a stroke of 30 in., and steam is supplied by two mild steel boilers, having Brown's patent furnaces and Kirkcaldy's compactum feed-water heater. They work at a pressure of 160 lbs. per square inch. Accommodation is provided for the officers in the poop and under bridge deck, while the crew are comfortably berthed under the topgallant forecastle. Adjoining the saloon is state-room accommodation for a limited number of passengers, everything being most comfortable and well appointed. The *Abertay* was launched about two weeks before the trial trip, with its engines, boilers, and masts fitted on board, as is the usual practice of the builders.

Georgias I.—On August 11th a trial trip took place of the new screw-steamer *Georgias I.*, built at the establishment of Messrs. Burmeister & Wain, Limited, Copenhagen, for account of the United Steamship Company, Copenhagen, who intend to run the new steamer between the Black Sea and the Baltic The steamer is specially fitted out for the requirements of this route, and is built of steel to Veritas highest class. She is 260 ft. long, 34 ft. broad, and has a depth of 19 ft. The engine is a triple-compound, there is one steam and one hand-steering gear, and water ballast can be carried both fore and aft and in the double bottom. There are several steam winches on board; she is schooner-rigged, and the lower part of the masts is of steel. Both the captain, the officers, and the passengers have their cabins amidships, and the men on the main deck. The *Georgias I.*, which is "well-decked," has a gross tonnage of 1,617 tons, 1,182 registered tons according to the Donau rules, which is equal to 1,033 tons English measurement.

Swainby.—On August 14th the screw steamer *Swainby*, a new vessel, 300 ft. by 40½ ft. by 22 ft., built by Messrs. Wm. Gray and Co., of West Hartlepool, for Messrs. Ropner & Co., of the same town, left West Hartlepool on her trial trip. Her engines, triple-expansion, of 190 H.P.N., with cylinders 23 in., 37½ in., and 61½ in. by 39 in. stroke, and working at 160 lbs. pressure of steam, having been built by Messrs. Blair & Co., of Stockton. The vessel made a most successful run, attaining a speed of 10½ knots per hour.

Goole No. 7.—On August 15th the new iron screw steam-tug *Goole No. 7* had her official trip at sea, when her capabilities were fully tested, the engines being worked at full power for more than five hours continuously without hitch of any kind. On leaving the Tyne a run northwards was made, and on returning a series of runs were made over the measured knot at Whitley, when a mean speed of 11½ knots were made. The contractors for this vessel are Messrs. J. P. Rennoldson & Sons, of South Shields, by whom she has been equipped and engined, the hull having been built by Mr. J. T. Eltringham. Her dimensions are:—100 ft. by 19 ft. 6 in. by 11 ft. 9 in. She is classed 100 A at Lloyd's, and is fitted with all the most recent improvements, including steam steering gear, steam windlass, water ballast tanks forward and aft, and has exceptionally large bunker accommodation. The engines are of the triple-compound type, of 75 N.H.P., having cylinders 14 in., 22 in., and 36 in., by 24 in. stroke, fitted with steam reversing gear, &c. The boiler, which is of extra power, is of steel, and adapted for a working pressure of 150 lbs. on the square inch, which pressure was fully maintained throughout the trial. The owners of this vessel, the Goole and Hull Steam Towing Company, Limited, of Goole, were represented by Mr. Mapplebeck, director, and Mr. Sutcliffe, secretary, who expressed their complete satisfaction with the results attained.

Bellucia.—On August 16th the fine steel cargo-carrying steamer *Bellucia*, built for Messrs. Bell Bros. & M'Lelland, by Messrs. D. & W. Henderson & Co., of Partick, had a successful

trial round the Cumbraes, and afterwards on the measured mile at Skelmorlie, when she showed an average speed of fully 11¼ knots per hour. Her dimensions are 310 ft. by 39 ft. by 26½ ft.; dead-weight capacity, 4,100 tons. She is fitted with Napier's windlass, Muir & Caldwell's steam steering gear, Sir William Thomson's compasses, and finished generally in a highly superior manner. After completing her trial the steamer left the Clyde for Liverpool, where, like the *Bellaura*, *Bellena*, and *Bellenden*, she will load under Messrs. Lamport & Holt's flag for the River Plate.

Dora.—On August 16th the screw steamer *Dora*, a new vessel, 257 ft. by 36 ft. 6 in. by 18 ft. 6 in., built by Messrs. Irvine & Co., of West Hartlepool, for Mr. Otto Trechmann, of the same town, left West Hartlepool for her trial trip. Her engines are of the triple-expansion type, of 140 H.P.N., with cylinders 20 in., 33 in., and 54 in. by 36 in. stroke, working at 160 lbs. pressure of steam, built by Messrs. Blair & Co., of Stockton. She made a most successful run, working without any hitch whatever, at a speed of over 10 knots an hour.

Pheasant.—On August 17th a very successful steam trial was made under forced draught by the *Pheasant*, 6, gunboat, outside Plymouth Breakwater. The *Pheasant* is one of the first vessels engined with machinery made in the factory at Keyham, and considerable interest has attached to her trial owing to this, as well as to the fact that the dockyard authorities contracted for the work with outside firms and managed to name a lower sum. Commander Prickett was in charge of the vessel, and Lieutenant Turner performed the navigating duties. The draught of water aft was 12 ft. 8 in. and 10 ft. forward, and the other results attained were:—Steam in the boilers, 130; vacuum, 23½ in.; revolutions, 185; total indicated horse power, 1,264; and speed by patent log, 13·4 knots. The *Pheasant* returned into harbour early in the afternoon.

Nigretia.—On August 20th, the new steel screw steamer *Nigretia*, built by Messrs. Raylton, Dixon & Co. for Messrs. Elder, Dempster & Co., of Liverpool, made her official trial trip with most satisfactory results. The dimensions of this vessel are:—Length 304 ft. 3 in., breadth 38 ft., depth 22 ft. 10 in., with engines of 200 H.P. by Messrs. T. Richardson & Sons, of Hartlepool. The party on board consisted of the owners, builders, and engineers, and after a few hours' satisfactory steaming she proceeded to Sunderland, where she will take in her coals. The *Nigretia* is, we understand, intended for carrying coals to the Grand Canary for the fleet of the African Steamship Company, of which Messrs. Elder, Dempster & Co. are the managers.

Theresina.—On August 20th the steamer *Theresina*, one of the Red Cross Line, owned by Messrs. Robert Singlehurst & Co., of Liverpool, went out on an official trial trip. The vessel has been laid up for some time, having her engines converted to triple-expansion, and a new boiler fitted, and considerable alterations made to her accommodation, a new topgallant forecastle having been erected, containing all rooms, &c., for firemen and sailors. The midship house has also been extended, and a complete new saloon fitted up amidships. During the run the machinery gave every satisfaction, the engines indicating 750 H.P., and working with great regularity, the vessel going 11 knots. The work of converting, &c., which has been carried out by Messrs. David Rollo & Sons, Fulton Engine Works, Liverpool, contains several novelties, notably the fact that, although the power has been increased fully fifty per cent., the machinery space has been reduced. The engines have been converted by fitting three cylinders 19, 30, and 48 inches diameter, and 30 inches stroke, the high pressure and middle pressure cylinders being fitted with piston valves, while the low pressure has a double ported slide valve of the design patented by Mr. Thom. The boiler, which is of steel, is 14 feet 10 inches in diameter by 10 feet 9 inches long, and four of Purvis' patent ribbed furnaces, fitted with patent Venetian air-valve fire bars. The working pressure is 160 lbs., and all the machinery has been made much in excess of the requirements of the Board of Trade for that pressure. The dimensions of the vessel are:—Length, 240 feet; breadth, 31 feet; depth of hold, 18 feet; gross tonnage, 1002. The work has been done under the superintendence of Mr. G. Hepburn, consulting engineer, and Mr. Isaacs, marine superintendent to the company.

Chamois.—On August 21st this vessel, 265 feet long, by 37 feet beam, by 18 feet 6 inches depth of hold, having engines 21·33 by 54, by 36 inches stroke, was taken on her trial trip. She has been built by Messrs. Doxford & Sons to the order of Messrs. Jackson Bros. & Cory, of London, under the inspection of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool, and on the trial trip the machinery ran very satisfactorily, driving the vessel at the speed on the measured mile of 11¼ knots. The vessel proceeded to her loading berth immediately after the conclusion of the trial trip.

Rosecliffe.—On August 21st the *Rosecliffe* s., which has been built by Craig, Taylor & Co., to the order of Messrs. Douglas H. Morgan & Co., of Newport (Mon.), had her trial trip. At the measured mile a speed of over 10½ knots an hour, mean, was attained; the maximum being 11½ knots. The vessel, which will load over 4,000 tons of cotton cargo, is being fitted for the Black Sea. The engines, which worked well during the trip, are by Messrs. Westgarth, English & Co., and indicated over 1,000 horse. The trial was satisfactory to all concerned.

Derwent.—Last month the new steel screw-steamer *Derwent*, constructed by Messrs. William Dobson & Co., of Low Walker, for the Goole Steam Shipping Company, was tried at sea, and, although a very strong gale was blowing, the vessel's speed was 14½ knots per hour. The machinery is by the Wallsend Slipway and Engineering Company (Limited), and worked satisfactorily throughout. This vessel is intended for the company's service between Goole and Rotterdam.

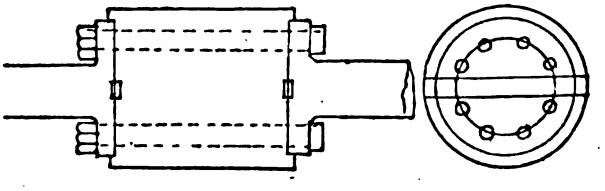
Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

To the Editor of The Marine Engineer.

A BREAKDOWN.

Sir,—Would you kindly allow me space in your valuable columns to give an account of a "breakdown," viz., loss of propeller, and the way in which it was temporarily repaired to reach England, as it might be of benefit to some of my brother engineers placed in the same difficulty. The "tail end" shaft was broken 5 in. outside of the stern tube, just at the end of the brass liner which runs in the stern bush. There was a new end turned on the shaft to fit the spare propeller, which made the "tail end" 3 ft. 6 in. shorter than originally. The brass liners were renewed and placed to suit the stern bush and gland, and the distance made up with a cast iron "short length" (as per Sketch). The shaft was 10¾ in. diameter and the cast iron 2 ft. diameter, and the couplings at each end were recessed into it 1 in., with two steel keys 2 in. × 1¼ in. to take the driving power, and eight steel coupling bolts through the whole of it. A temporary bearing was fitted at the forward side of it, so that it was supported by the stern gland on the one side and the bearing on the other.



It has run the ship from Piræus to the Black Sea and back to England, and has answered our purpose admirably, and saved a considerable amount of time, the alternative being to take shaft to Constantinople to get new end welded on.

Thanking you in anticipation,

I remain yours, &c.,

C. DOBSON,

Chief Engineer.

SPACE OCCUPIED BY MACHINERY AND NET TONNAGE.

To the Editor of THE MARINE ENGINEER.

SIR,—During the past few years much has been done by our marine engineers to economise fuel, weight, and space occupied by machinery. The first and second have borne good fruit, but the last has not, so far, been of much advantage. The fault, however, does not lie with the engineers, but with the tonnage laws, which like those of the Medes and Persians seem to be unalterable.

The present method of computing the net tonnage is pretty well known, and more especially to shipbuilders who have no doubt in many cases paid for their experience.

In order to obtain a reduction of 32 per cent. it is necessary that the space occupied by machinery equal 13 per cent. of the gross tonnage; should it fall under this however slightly, then one-and-three-fourths of the actual measurement only is allowed.

This matter was brought prominently before me lately in connection with a steamer with which I have something to do. The vessel in question is 312 by 40½ by 22·3 moulded, and is fitted with quadruple engines capable of developing about 1,200 H.P. In arranging the details it was found that the length necessary for the engineer's requirements was 37 ft., which was ample allowance for efficient working of the machinery. In going into the calculation for tonnage, however, it was found that the length would require to be increased to 46 ft., in order to get the 32 per cent. allowance. The owners were naturally much displeased at so much valuable space being wasted, and thinking it would be more advantageous to throw the tonnage question overboard, went into the matter as to whether the space saved in the engine-room would be more valuable than the reduction in tonnage, but arrived at the conclusion that it was better to sacrifice the space.

The net tonnage with the 32 per cent. reduction was 1,850 tons, whereas the other was 2,140 tons, or a difference of 290 tons.

It is astonishing that no attempt has been made to alter this empirical rule of computing net tonnage. What difficulty would there be in adopting a sliding scale. If 13 per cent. gave 32 per cent., what would 12 per cent. or 16 per cent. give? Make the 13 per cent. the basis, if necessary, but let the allowance be *pro ratâ* of the actual percentage of the engine-room, and by such means prevent space being simply thrown in as it were for a certain purpose. The quadruple tandem engine lends itself to economy in space more than the triple type, and as economy in fuel, &c., follows, it seems ridiculous that the advantages are to be neutralized through the obstacles placed in the way by the tonnage laws. Again, our fast passenger steamers do not get the advantages which should accrue from their large engine-room. Were they to have their net tonnage computed on the sliding scale there would be a considerable diminution of their net tonnage.

No doubt the question is a large one and would open up a wide field for discussion, but if the shipowner who has for some time past suffered from low freights wishes to take any advantage of the space available, he should not let the matter rest.

J. P. W.

Glasgow, July 23th, 1888.

SLIDE VALVE GEARS.

To the Editor of THE MARINE ENGINEER.

SIR,—I have read with great interest Mr. Milton's Paper on valve gears, as reported in your Paper, and regret that I had not the opportunity of sending him some information on the subject of my own special form, of which he appears to have had very little. Nothing would have given me greater pleasure, and among the information I have gathered on this and kindred subjects many interesting facts have come out.

I regret also that I was not able to be at the discussion, for as from the time that I was an office pupil to Messrs. Shepherd and Todd, engineers, where I was associated with the first introduction of expansive valve gear on locomotives (when on marine engines, as far as I know, the only expansion gear was the Cain), I have made valve gears my special study, and, in following the rises of pressures of steam in both departments, have gathered a good store of facts in the two collateral subjects, which I should have been happy to give to the meeting, to help a discussion which appears to have somewhat flagged.

I see that a good deal was said about a valve gear which has been several times brought to me as a new invention, but in which I at once recognised the form well known to those familiar with engineering progress on the Continent as the Walschert gear. The statement, however, that this gear has made such a wonderful record, and beyond all other gears, must have been made without the knowledge of the vastly greater progress made by the valve-gear usually known by my name, and of which there are over 200,000 I.H.P. in marine engines (including the largest complete set of engines yet built); of these about 60,000 I.H.P. are on the sling-link plan, and about 150,000 I.H.P. on the slide-block system, showing that a large number of engineers do prefer this plan chiefly for its simplicity, and with good design and good work the plan has proved itself perfectly satisfactory for many years of collar work. Besides, there are over 800 locomotives all on this slide-block plan, as it lends itself so admirably to the requirements of the locomotive—simplicity, solidity, and accessibility. Some of these engines have joined in the great railway race now terminated.

As proof of the endurance of these blocks, I have in my office a set taken from a large express goods engine after four years' continuous work. They were then in perfect condition, and plenty more work in them, and were only taken out for me by the courtesy of the chief engineer of the railway company, to serve as proofs of their endurance. This very extensive adoption is proof enough that this gear meets the demands of modern construction, and this not only for marine engines, but for locomotives equally. I am further simplifying its adoption by employing only two sets of valve-gears to work the valves of a triple engine, the middle valve getting its motion from a floating lever worked combinedly by the other two. The indicator cards from such engines leave nothing to be desired. This system has been illustrated more than once in the mechanical journals, and is now being built on the Continent up to 4,500 I.H.P. And I have not got to the end yet. Other improvements which I am following with will be departures in a fresh direction; for if advance is to be real, it will not be won by the resuscitation of old inventions, but by daring to strike out on new lines.

Yours faithfully,

DAVID JOY.

9, Victoria Chambers.

THE NAVY.

To the Editor of THE MARINE ENGINEER.

SIR,—I beg to invite your serious attention to the very unpardonably misleading statements, omissions, &c., in the Parliamentary Return, 218, June 12, 1888, just issued, which for convenience I will designate (*a*), and which are corroborated so as to prove them to be deliberately done, because Mr. Forwood at Liverpool, July 9, 1888, used the same in his address, which I designate (*b*), and which a letter in the *Marine Engineer* and its powerful aid will correct.

Lists (*a*) and (*b*) show the following as battleships, French and English:—

Names	Date of Launch.	Tons.	Speed.	Armament.	Armour. Lloyd's, Mar.
English.			Knots.		
1. Hotspur ..	1870	4,010	12·6	2 12 in. M.L.	11in.
2. Rupert.....	1872	5,440	13·6	2 10 in. M.L.	11 in.
3. Belleisle ...	1876	4,870	12·2	4 12 in. M.L.	12 in.
4. Orion	1879	4,870	12·8	4 12 in. M.L.	12 in.
5. Penelope ...	1867	4,470	12·7	8 8 in. M.L.	8 in.
6. Iron Duke and four others (X)	1870	6,010	12·5	10 9 in. M.L.	8 in.
		6)29,670	76·4		6)62 in.
		Mean 4,945	12·4		Mean 10·3 in. Lloyd's
French.					
1. Furieux ...	1883	5,709	14·0	2 13·4 in. B.L.*	20 in.
2. Tonnerre...	1875	5,703	14·0	2 10·6 in. B.L.*	13 in.
3. Fulminant.	1877	5,600	13·2	2 10·6 in. B.L.	13 in.
4. Tempête ...	1876	4,523	12·0	2 10·6 in. B.L.	13 in.
5. Tonnant ...	1880	4,707	11·3	2 13·4 in. B.L.*	18 in.
6. Vengeur ...	1873	4,523	10·8	2 13·4 in. B.L.*	13 in.
		6)30,763	75·0		90 in.
		Mean 5,125	12·5		15 in.

* Three 48-ton guns, B.L.

Thus we have two turrets and ten broadside vessels on the "Battleship" list. The mean of six being of older date, inferior tonnage, very inferior armament (three French mounting 48-ton gun, all B.L., while ours are M.L., obsolete), armour very inferior, mean 10 in. to 15 in. Two vessels armoured 20 in. and 18 in., speed one-tenth of a knot superior; while the six French

so-called in (*a*) coast defence armour-clads are put on the inferior list. This should be reversed. These unpardonable misstatements are too palpable to need argument. Brassey writes, p. 168, vol. i., Note—"It should, perhaps, be pointed out that it is intended by the use of the term 'coast service vessel' in the text to connote a class capable of rather more extended employment than would be expressed by the words 'coast defence' vessels. Like our own *Hotspur* and *Rupert*, the former could proceed to and be employed on an enemy's coasts."

Brennus, French "Cuirassée d'Escadre," is placed on list (*a*) as approved to be built. French Navy Estimates Rapport, dated December, 1887 (styled later *f*), states, p. 24, the number of "Journées" in 1888, and at p. 130, *id.*, "The money to be expended in 1888." Though no remark is used on (*a*) or (*b*) about *Blake* (whose design is not settled), see Navy Estimates, 1888-9. Mr. Forwood omits *Brennus* altogether; and both (*a*) and (*b*) call the French "Croiseur de 1ère classe Blindé, *Dupuy de Lome*" (the most powerful armoured cruiser in the world) "unarmoured."

The omissions of good vessels in (*a*) and (*b*) are very many.

Mistakes about torpedo vessels very numerous. As follows:—See (*f*) p. 109, Tableau B., No. 2,030, *Bengali*, *Lézard*, *Cicogne*, &c. "Eclaireurs torpilleurs à grande vitesse" N···, N···, "Torpilleurs de haute mer," ten in number, named in (*f*) p. 122; 15 vessels, speed 22 knots. In short, by list (*a*) six armoured turrets are taken from the French battleship list, also one most powerfully armoured cruiser from the cruiser list—total 6 and 15 torpedo vessels, see list (*f*), p. 122—109. One armoured cruiser styled unarmoured. It is impossible for Parliament, in fact for any one, to see through these unpardonably misleading inaccuracies, One must be thoroughly deceived. Nevertheless, p. 14, list (*a*), gives "torpedo vessels completing and building—*nil*."

I am, Sir, your humble servant,

ADMIRAL OF THE FLEET, THOMAS SYMONDS.

Torquay.

SLIDE VALVE GEARS.

To the Editor of THE MARINE ENGINEER.

DEAR SIR,—In the publication of Mr. Milton's paper in your issue of August 1st, 1888, my valve gear described in patent No. 2,037, 1879, and now known as the Bremme valve gear, is referred to as Marshall's.

On referring to the dates of the respective patents and also to my license agreement of March 18th, 1882, with Messrs. R. and W. Hawthorn, also signed by Mr. Marshall, it will be found that Mr. Milton's statement and allusion are wrong.

As this part of Mr. Milton's paper causes a wrong impression tending to injure my interest, I hope you will publish this letter in your next issue.

Yours faithfully,

GUSTAV A. C. BREMME.

August 9th, 1888.

FORCED DRAUGHT.

To the Editor of the MARINE ENGINEER.

SIR,—Having seen at different times articles on forced draught in your columns, written by gentlemen who are credited with being authorities on the subject, I should feel obliged if you would allow me to ask a question relative to this subject, which I have had no opportunity of proving, not having sailed with any but natural draught.

It being known and understood that the temperature of a gas is increased by compression, may not some of the economical results of forced draught be due to the increased temperature induced by the compression necessary to give the gases the required velocity, and might not increased compression be followed by increased economy? This suggestion is somewhat borne out by a statement made to me the other day to the effect that the best results were obtained with the damper partly closed, which implies greater compression in the tubes and furnaces.

This may account for the superiority of the closed stokehole method over the fan in the chimney, which, as it draws the air up, lessens its density, and, therefore, its capacity for heat.

Thanking you in anticipation for inserting this, and trusting some of your correspondents may favour me with this information, I remain, Sir, very truly yours,

ROBERT FREDERICK TAPLIN.

Liverpool, August 19th, 1888.

INCAPACITY OF THE MACHINERY OF WARSHIPS.

To the Editor of THE MARINE ENGINEER.

SIR,—After reading the Correspondents' interesting letters from the fleets in *The Standard* of August 13th I cannot resist writing to ask a question which has often been asked before, but to which I have never heard a satisfactory answer.

How is it that if any number of vessels belonging to our fleet are sent to sea for a week or ten days one always hears of a large proportion becoming incapacitated in their machinery, and most of the others not performing their expected speed, when every month vessels belonging to the various steam-ship Companies perform the passage to New York and back (some six thousand odd miles) without a hitch?

Can the reason be that the machinery supplied to the Admiralty is not of the high quality insisted upon by the direction of these Companies, and not only insisted upon, but duly supplied to them?

I am, Sir, your obedient servant,

MILES.

August 13th.

UNITED SERVICE LIFE BOATS.

To the Editor of THE MARINE ENGINEER.

DEAR SIR,—For three blessed sessions of long Parliament the British public have been promised unlimited legislation in order to obtain unlimited boat accommodation for the saving of life at sea by means of boats, rafts, and life-saving apparatus, but as yet everything has been saved for the present until a more urgent or more convenient occasion, and all this large promise and short attainment has kept up the old precedent of trying how not to do it of the "Circumlocution Office."

The kind and forbearing attention of your readers has very often been directed to the question of making armed merchant cruisers and all sea-going vessels more like lifeboats, fit to live in any stormy sea.

The recent practical experiences in the experimental cruise of H.M. *Sandfly* has demonstrated that this is still necessary with torpedo launches.

The attention of the Royal National Lifeboat Institution has been requested to the due celebration of the first centenary of the first Northumberland lifeboat being launched at the mouth of the Tyne on the 30th of January, 1790, by inaugurating the adoption of a Universal United Service Lifeboat, fit for anything both on the coast and at sea, available also as a military pontoon, steam lifeboat or torpedo launch, or boat sleigh for land transport; also over ice, snow, arid desert sands, or across mountain ranges, &c., assisted by wire-rope railways and a portable purchase. Wherever British men-of-war or a merchant vessel is there would then be lifeboats and lifeboat crews, all efficient for service at a moment's notice either in harbour or at sea. Kindly invite discussion and oblige,

Yours sincerely,

GEORGE FAWCUS.

9, Vio del Conservatoire del Mare, Genoa,
August 6th, 1888.

PROPOSED SHIP CANAL.—The project of a maritime ship canal to connect Bristol with the English Channel is being revived, and it is understood that a syndicate is in course of formation with a view to its promotion. This plan has long been favoured by many of those interested in mercantile and commercial pursuits, and the feasibility of the suggested undertaking has, it is understood, been favourably reported on by eminent engineers. It is proposed to construct a ship canal from Bridgwater Bay, commencing at Stolford, on the Somerset coast, *viâ* Taunton, and terminating at Seaton on the South Devon coast. The length of the proposed canal will be 45 miles, and it is proposed to make it of sufficient capacity for vessels of the largest tonnage. The great recommendation of this proposed connection of the Bristol and English Channels is that it will effect a saving of nearly 300 miles, its main object being to get rid of the necessity for ships plying from the Bristol Channel to the English Channel ports, the Continent, and the Baltic, &c., being compelled as they are now to go round the Land's End, the Lizard, and past the Cornish and North Devon coast. It is also suggested that Stolford and Seaton, at either end of the proposed canal, could be converted into efficient harbours of refuge. The cost of construction is at present roughly estimated at £70,000 per mile.

Miscellaneous.

THE DUCHESS OF SUTHERLAND.—The London and North-Western Railway Company some months since placed their paddle-wheel steamer *Duchess of Sutherland*, built in 1861, in the hands of Messrs. Laird Brothers, Birkenhead, for conversion into a twin-screw steamer, with the expectation that her efficiency for their cross Channel cattle trade would be improved, and that considerable gain in economy would result from the introduction of more modern machinery. The work has now been completed, and, August 11th, the vessel made a trial outside the port, attaining a speed of 14½ knots, the engines developing 1,400 H.P. Having since been handed over to the company's officers, the *Duchess of Sutherland* steamed down to Holyhead on Aug. 18 to resume her place on the station, making the run from the Rock Light to Holyhead Breakwater in 44 hours, which, allowing for tide, gives a speed of fully 14½ knots an hour, the machinery working with the greatest smoothness at 116 revolutions and developing 1,400 I.H.P. The alterations effected in the steamer may be briefly described as follows:—The old machinery and paddle-wheels and boxes have been removed, but the forward and after sponsons and their houses on each side have been retained and connected, the houses forming quarters for the ship's officers, store-rooms, &c., the old paddle-wheel space decked over and formed into a large additional space for cattle. The necessary alterations have been made about the stern of the vessel, and stern tubes and brackets fitted, and the arrangement of engine, keelsons, bulkheads, and coal bunkers, &c., have been modified to suit the new machinery. This consists of two sets of triple-expansion engines, having cylinders 16½ in., 26 in., and 41 in. diameter, with a stroke of 2 ft. 6 in., and working at 150 lbs. pressure, steam being produced by two double-ended cylindrical steel boilers, each set of engines driving its own propeller. The results of the alteration may be summed up as follows:—The carrying power of the vessel has been increased by about 190 tons, large additional deck space for cattle being gained, while the net register tonnage has been reduced by 247 tons. The speed has been considerably increased, and the consumption of fuel will be reduced by 60 per cent.

THE KEARSAGE.—A valuable relic of the Kearsage is preserved at the Mare Island Navy Yard, namely the figure-head of the famous vessel erected on a handsome pedestal. An enclosure has been formed with dismounted cannon and chains, and on this is a flag-staff, from which floats the stars and stripes. The American *Army and Navy Journal* says this is guarded by mounted field-pieces, and close beside it stands the figure-head.

LLOYD'S SHIPBUILDING RETURNS.—From Lloyd's shipbuilding returns for the month of July, it appears that the vessels built under the survey of the Society were as follows:—Total number of steamers, 37; gross tonnage, 19,237, plus tonnage of 24 steamers (tonnage not stated). Total number of sailing vessels, 9; gross tonnage, 8,889, plus tonnage of two vessels (tonnage not stated).

A NEW FAST ATLANTIC STEAMER.—A new fast Atlantic steamer for the American-Hamburg Company is shortly to be launched from the Vulcan Yard, near Stettin. The vessel is 460 ft. long and 56 ft. broad. The engines are to be of 12,000 to 14,000 I.H.P., and to realise a speed of 19 knots per hour. There are eight six-furnaced boilers of 55 to 68 tons each, 5·982 m. long, 4·600 m. diam. The compound engines have high-pressure cylinders 1·050 m., intermediate 1·700, and low-pressure 2·700 diam., with a stroke of 1·600 m. At the same yard the keel of another new fast steamer for the North German Lloyd Company has just been laid down.

SIX NEW TORPEDO BOATS.—It has been decided to order six new first-class torpedo boats this year. Their torpedo armament is to consist of one right-ahead tube and two broadside tubes on the after conning towers. Six of the former tubes from the 125 ft. Thornycroft boats are to be utilized for the right-ahead tubes of the new craft. The deck tubes for three of the boats are to be made at Portsmouth and the others at Sheerness. The mechanism and electric gear are also to be fitted at the yards.

ANOTHER PROJECTED SHIP CANAL.—During the past month the Sheffield Chamber of Commerce has taken up the question of water communication between Sheffield and the coast. The heavy railway charges seriously hamper many local industries, in addition to which some of the larger steel productions of the district do not easily adapt themselves to railway carriage. A rough inspection of the waterways between Sheffield and Goole has already been made, and a committee appointed to consider the whole subject and ascertain in what way water communication can best be improved so as to afford cheap water carriage for the district. The committee includes manufacturers, landowners, and coal-owners.

BARRY DOCK AND RAILWAY.—The half-yearly meeting of this company was held at Cardiff last month, Lord Windsor in the chair, when the engineer's reports were presented, showing that the breakwaters, earthworks, and masonry of the dock and basin were nearly completed; that the foundations of the coal tips on the north side were finished; that the tunnel by St. Fagan's was nearly completed; that by Pontypridd completed and lined, and the junctions laid by the Taff Vale Railway Company; that the hydraulic pumping engines were ready for erection; and that everything was nearly finished, so that no doubt the dock would be opened next year. It was further stated that contracts had been entered into with Messrs. Sharp, Stewart & Co. for supplying twenty locomotives. All these engines will be delivered next year. The directors' report was adopted. It was stated that the sum received upon shares during the past twelve months was £1,334,179.

THE IMPROVEMENT IN SHIPBUILDING.—Mr. Knight, the secretary of the Boilermakers' and Iron Shipbuilders' Society, in his monthly report, says:—From the commencement of the year there has been a gradual improvement in all the branches of our trade, and the future outlook is very encouraging, as there is plenty of work for all classes of vessels at good paying rates, and tonnage is scarce. This will bring more work to the shipyards, as inquiries are still brisk, and there is every probability that large accessions to the order books of our builders will continue to be made. Taking the carrying trade all round, there are few routes in which the out and home voyages together do not leave a good margin of profit. The shipping industry is in a healthy condition. Our shipyards and boiler shops are therefore well employed, and many of them have work enough to keep them going until next spring.

ENGINEERING IN THE WHITE STAR FLEET.—EXTRAORDINARY TRAVELLING.—It will interest his numerous friends to know that Mr. Sewell, the chief engineer of the White Star steamer *Britannic*, and senior engineer in the company's service, has just bid farewell to the ship in which he has been so long and favourably known, in order to familiarise himself with the machinery of the larger new steamers which Messrs. Harland & Wolff are constructing for the company. Whilst in charge of the engine department of the *Britannic* Mr. Sewell has completed 132 round voyages between Liverpool and New York, and travelled the enormous distance of 818,400 nautical or 941,000 English miles, nearly four times the distance between the earth and the moon. The engineer appointed to succeed Mr. Sewell is Mr. Kitchen, who has held the position of chief-engineer in the *Adriatic* for the past 16 years. Mr. Kitchen surpasses even Mr. Sewell in the number of voyages accomplished and distance traversed. He has made 154 round voyages between Liverpool and New York in the same ship, and travelled over 954,800 nautical or one million one hundred thousand English miles! During this long period Mr. Kitchen has been so fortunate as not to have had the slightest disablement of any kind in his engine-room, and has contributed greatly to the favourable reputation which the *Adriatic* has earned as one of the swiftest and most regular ships on the Atlantic. In 1887 the *Adriatic* made thirteen round voyages from Liverpool to New York and back, a feat which has only been equalled by the *Germanic* of the same line. Both engineers have gained the esteem of their employers, and every one who knows them will cordially wish them success in the future as in the past.—*Liverpool Courier*.

ADMIRALTY CONTRACTS.—The Admiralty have placed with Messrs. R. & W. Hawthorn, Leslie & Co., of Newcastle-on-Tyne, a contract for the hull and machinery of H.M.S. *Bellona*, the estimated value of which is £80,000; also the machinery for the duplicate vessel H.M.S. *Barham* building at Chatham, of the estimated value of £36,000. A contract for three cruisers for Colonial defence has been placed by the Admiralty with Messrs. Armstrong, Mitchell & Co., of Newcastle-on-Tyne, the contractors for the machinery being Messrs. R. & W. Hawthorn, Leslie & Co. of that city.

THE SECOND BEST ATLANTIC TRIP.—It is not often that it is reserved for the same vessel to make both the first and second "bests on record," but this proud distinction has been secured by the Cunarder *Etruria*. As will be well recollected by our readers, this magnificent vessel some few weeks ago astonished the maritime world by making the run between Queenstown and New

York in 6 days 1 hour and 55 minutes, and thereby beating the best previous record made by her sister ship, the *Umbria*, by 2 hours and 52 minutes. Her time for the second best trip yet made was 6 days 3 hours and 15 minutes, the average run throughout being 19·3 knots per hour, and this in spite of heavy head seas and a moderate gale encountered on the first day out, while further a 3 hours' fog was encountered on the last day.

Contracts for Dundee Shipbuilders. — Messrs. Alexander Stephen & Sons, Dundee, have contracted to build a lightship for the Board of Trade. The vessel is to be constructed of wood, and will be about 250 tons register. Messrs. W. B. Thompson & Co. (Limited) have contracted to build a steamer for the Dundee, Perth, and London Shipping Company. The vessel is designed for general trading, to carry about 2800 tons of cargo. She will be fitted with triple-expansion engines. Messrs. W. B. Thompson and Co. have also obtained an order for the construction of a twin-screw tug for the Shropshire Railway and Canal Company.

Fast Cruisers.—At the United Service Institution (on June 29th)—Admiral Sir E. Fanshawe presiding—Sir E. J. Reid, M.P., read a paper on "Fast Cruisers," with a view to urging upon the authorities the desirability of increasing the number of swift vessels rather than those of insufficient speed. He considered that from the year 1880 downwards there had been a great waste of public money in the production of ships for the Royal Navy of insufficient speed. At least 50 war vessels had been built in that period at a cost of nearly 4,000,000*l*., and while not one of them attained even a measured mile speed of 14 knots, 32 of them fell short of 13 knots, one-half fell short of 12 knots, while others were as low as 9¼ knots per hour. The consequence was that many of them had already been condemned as useless for war purposes. It was proposed during the present year to spend 381,000*l*. for several vessels varying from 12 to 14 knots an hour, and looking to the vast extent of our mercantile marine he thought such conduct most unwise. Some of the projected vessels were not yet commenced, and he strongly urged that they should be abandoned. A brief discussion ensued, in which Admiral Boys, Captain Henderson, Mr. W. Baden-Powell, and Captain Curtis took part. The Chairman having conveyed the thanks of the meeting to the reader of the paper, the proceedings terminated.

The Shipping of Liverpool.—The annual return issued by the chief accountant to the Liverpool Dock Estate of the number and tonnage of vessels paying rates and the amount of such rates for the year ending June 30, shows an increase over the figures for the year ending June 30 last year. The total number of vessels paying dock and harbour rates for the twelve months just ended was 22,421, with a tonnage of 9.017,935. The figures for the previous year were: vessels, 21,884, tonnage, 8.797,783. The amount paid in harbour rates, dock tonnage rates, dock rates on goods, and town dues on rates in the twelve months just ended was £1,012,798, in the previous year £1,004,127.

"Science and Art."—It may interest our readers to know that the examination papers set in Machine Construction and Drawing at the recent examinations of the Science and Art Department will be worked out by Mr. Henry Adams, M.I.M.E., and published in the August and September issues of our contemporary "Science and Art," copies of which may be obtained from the office, 11, Henrietta Street, Covent Garden, W.C.

Two-bladed and Four-bladed Propellers.—It would appear from experiments made in the Danish navy that there is but little difference in the efficiency of the two-bladed and four-bladed propellers, the same blades being used in each case, so that the loss of one-half of the propeller surface was balanced by the lessened friction. At speeds greater than 12 knots, however, the vibration with the two-bladed propeller was excessive.

Messrs. Forrestt and Son.—These well-known yacht and shipbuilders of London have lately extended their business by taking the Shipyard, Wyvenhoe, Essex. This shipyard is now being very much enlarged, and a dry dock will shortly be constructed to take the largest vessels likely to come up the river Colne. They have already a patent slip and large commodious sheds for building under them all classes of yachts and small Government craft.

A Monster Flagstaff.—Messrs. Forrestt and Son, yacht and shipbuilders, of Wyvenhoe and London, have lately built and fixed upon the roof of Mr. Whiteley's premises in Queen's-road, Bayswater, the highest flagstaff in London. The flagstaff represents a cutter yacht; the lower mast is an Oregon pine, and the topmast is pine and is a fitted one. All the standing rigging is of galvanised iron wire rope. The total height from the pavement in Queen's-road to the truck is 226 ft. The flag flying from the topmast truck is 8 yards long.

Sawing Cold Iron and Steel.—The introduction in shipbuilding of Z pattern angles, combining, as they do, reverse bar and frame in one, has made it necessary to provide other means than the ordinary angle shears for cutting superfluous portions from the frame, both transversely and obliquely, as the needs arise. The sawing-machine manufactured by Mr. Isaac Hill, Derby, appears to answer this purpose admirably, and it is consequently being adopted by many of the leading shipbuilding firms in the North. Messrs. J. P. Thompson & Sons, of the North Sands Yard, Sunderland, who are always among the first to adopt any useful improvement, were in the early part of last year supplied with one of these machines by the local agents, Messrs E. Beckwith & Co., Newcastle and Sunderland, and its working has given the most unqualified satisfaction. Since then Messrs. Armstrong, Mitchell & Co. have provided themselves with three machines (one for the Elswick ship-yard and two for steel works), and Messrs. Withey & Co., Hartlepool, Messrs. Gray & Co., Hartlepool, Messrs. Dorman, Long & Co., Middlesboro', The Teeside Engineering Co., Middlesboro', and Messrs. Ashmore, Benson, Beason & Co., Stockton, have each purchased one machine. All of these are now at work, and giving entire satisfaction. From the names of the firms given above it will be seen that the machine can be usefully worked in other industries besides shipbuilding—wherever, indeed, there is iron or steel to be cut asunder while in a cold state. Messrs. C. S. Swan & Hunter, Wallsend, have recently ordered one of these machines from the local agents, and it is expected to be delivered in the course of a few days.

Two New Steamers.—The Bergsund Engineering Company, Sweden, has just completed delivery of two new steamers, one a steamer intended for river traffic and the other a tug-boat. The former has been christened *Turisten*, and is built on account of the Sundsvall-Indalselfcens Steamer Company, being intended to run between the former town and up the Indal River. She is 100 ft. long and 20 ft. broad, and is with a cargo of 15 tons only 2½ ft. draught. She has two engines (condensers) of 16 H.P., each being connected with a propeller. The speed is about 10½ knots, wood being used for fuel. The hull is of Bessemer steel, the boiler of Siemens-Martin steel, and the bulkheads, bunkers, &c., of English iron; the propellers are of gun iron. The *Turisten* is well fitted out, and is a first-class passenger steamer. The tug was commenced "on spec," but has subsequently been sold to the Harge Glass, Lime, and Brick Works. She has a 16 H.P. engine, and is built of the best material, having more accommodation on board than is generally the case with boats of this kind.

The Devastation.—It is intended to provide the *Devastation*, the earliest of the sea-going turret ships, not only with a set of modern engines and boilers (for which the contracts are out), but with an improved armament. At the present time she carries in her turrets four 12 in. 35 ton muzzle-loaders, the most powerful guns in existence at the date of her completion. Her new armament will consist of four 10 in. 29-ton breechloaders, and the representatives of three contracting firms have been authorised by the Admiralty to inspect the gun-mountings of the *Thunderer* at Portsmouth to assist them in designing the gear for the new guns. When rehabilitated and brought up to date the *Devastation* will be one of the most formidable and useful ships in the Navy.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from July 13th to August 16th, 1888.

10204 R. Morris. Propelling ships.
10210 R. Stevenson. Propulsion of torpedoes, ships, &c.
10215 B. Piffard. Ships or vessels.
10248 A. W. Robertson. Shipping and unshipping coal, &c.
10260 M. Gledhill. Metal tube for covering propeller shaft.
10262 Ditto Cylinders, armour-plates, projectiles, &c.
10271 J. Cosens. Boat-sail hook.

10284 J. Nicholas. Explosives.
10287 H. Holden. Sounding-lead.
10289 S. Robinson & G. Seymour. Steam-engine piston.
10297 G. N. Rozio. Ventilating ships, &c.
10299 Wallace (P. Scott). Electric logs.
10304 A. J. A. Menant. Connecting lengths or sections of boats, troughs, &c.
10323 J. Cosens. Hoisting and lowering boats.
10331 R. Macintyre, sen. Consuming smoke and economizing fuel in steam boilers
10335 W. Fairclough. Prevention of scale in steam boilers.
10345 J. B. Hannay. Preventing corrosion in steam boilers.
10372 W. Butterfield. Steam-engine valves and valve gear.
10380 R. Baillie. Coaling ships, &c.
10388 J. White & J. G. H. Hill. Sheet-metal boats.
10413 G. Macdonald & W. Brown. Stuffing box and packing.
10457 J. Langfield. Heating saloons and cabins of vessels.
10474 R. Harvey. Ships' propellers.
10480 W. W. Fuzzey. Conveying postal matter at sea.
10496 J. Battye. Fuel economiser, &c., for boiler furnaces.
10500 T. Bolton. Range-finder.
10506 J. A. Radley. Centrifugal pump.
10519 A. Pickard. Construction of canals.
10534 H. Skelton & B. Sutcliffe. Flexible steam or other joint.
10535 R. W. Allen. Screw propellers.
10538 O. C. Mootham. Buttons of oars or sculls.
10594 A. Damaskinos. Propelling ships.
10601 R. Turnbull. Anti-corrosive compositions for ships.
10603 L. Hussey. Feed water heater.
10639 A. M. Wood. Collapsible boats.
10656 G. A. de Penning. Stuffing boxes.
10697 West (R. de Maórtua). Indicating draught of vessels.
10711 O. Kohn. Rotary engine.
10730 A. Noble. Electric-firing gear for guns.
10760 G. Chapman. Communicating treble power to ships' propellers.
10771 R. Werner. Propelling boats.
10786 Haddon (W. B. Allyn). Rotary pumps and motors.
10797 J. Proctor. Furnace doors.
10800 A. Earnshaw. Adjusting steam-engine governors.
10833 W. M. R. Quick. Holding articles on ships.
10834 W. H. Wilson & W. J. Pearie. Steam steering gear.
10872 J. Fielding. Shipping coal, &c.
10878 S. Hanson. Supplying fuel to boiler furnaces.
10884 Thompson (R. Dörfel). Steam-engine valve gear.
10912 R. Scott. Preventing vessels from stranding.
10931 J. H. Amour. Ships' log.
10932 Ditto Ships' power steering gear.
10943 G. & J. Stones. Variable automatic cut-off mechanism for fluid-pressure engines.
10951 P. Molnar. Paddle wheels.
10962 F. Purdon & H. E. Walters. Utilizing the force of running water as motive power
10971 J. Hoyle & J. Harrison. Regulating the speed of steam engines.
11007 S. A. Johnson. Unsinkable ship or vessel.
11031 A. B. Wilson. Steam-engine governor.
11035 J. Thomas. Engine packing.
11045 J. T. Dawes. Application of steam to obtain motive power.
11048 J. H. Yeo. Life-saving sea-chest.
11052 H. Withy & G. W. Sivewright. Portable grain-divisions in vessels.
11102 W. D. T. Travis. Buoying vessels.
11115 J. J. Pearson & T. H. Taylor. Pressure-reducing valves.
11148 T. R. Douse. Subduing fires on ships.
11160 Redfern (A. Lagrafel & J. d'Allest). Marine boilers.
11173 A. Francis & E. Manbré, Obtaining more perfect combustion in boiler furnaces.
11183 Y. J. Hamilton. Furnace bar.
11206 W. Wood. Steering apparatus of ships.
11209 A. J. Davison. Non-corrosive and anti-fouling compositions.
8002A Groth (J. F. Monnot). Driving capstans.
8002B Ditto ditto Life rafts.
11228 A. T. Allen. Metallic packing.
11231 C. Smith, jun. & R. Williams. Regulating and indicating the speed of motive engines.
11255 J. Patten. Metallic packing.
11289 J. Chorlton & G. L. Scott. Ships' berths.
11301 Horn (D. Ruggles). Signalling at sea.
11303 J. W. Melling. Governor for engines.
11311 C. Elliott. Steam winches.
11317 J. Ellis. Cleaning steam boiler feed-water passages.
11367 T. Manwell. Floating signal light and life buoy.
11370 Samson Fox. Multiple cylinder motors.
11375 A. Gough, jun. Steam engine.
11408 G. A. Lewis. Screw-propulsion of ships.
11410 A. D. Hall & G. B. Sloan. Screw propellers.
11448 P. Evans. Mechanical propulsion and steering of vessels.
11498 T. D. Worrall. Propulsion of vessels.
11513 R. F. Bell. Motive-power engine.
11535 C. F. Crapp. Calming waves in stormy weather.
11618 W. L. Strong. Propeller wheel.
11630 G. E. Cory & B. A. Barczinsky. Submarine vessels.
11662 W. Shapton. Dredgers.
11685 H. Middleton. Motors of submarine ships.
11689 R. Robinson. Engine governors.
11699 W. V. Shaw. Ships' davits.
11700 W. H. Daniels. Screw propeller.
11707 T. T. Woodruff. Screw propulsion.
11712 W. B. Cumming. Metallic packing.
11714 S. Davenport & E. Ingham. Engine-speed regulators.
11716 G. S. Hill. Fuel economiser and smoke consumer for steam boilers.
11729 A. Robert. Engine-valve gearing.
11771 J. Crowther. Engine regulator.
11835 Lake (W. W. St. John). Cut-off valves for steam engines.
11846 Clark (G. N. Hubbard). Rotary concentric piston steam engines.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1 C, denotes First Class ; 2 C, Second Class.

July 28th, 1888.

Allan, Collin....	1C	Liverpool
Borris, Christian	1C	N. Shields
Cahill, Patrick ..	2C	Liverpool
Cain, John	1C	,,
Cresswell, W. ..	1C	N. Shields
Dowd, Thomas...	2C	,,
Firth, John W. .	2C	London
Fitzmaurice, C. M.	2C	Liverpool
Forbes, John H.	1C	London
Garrett, W. H.	1C	Liverpool
Halliday, James	1C	N. Shields
Harding, B. J...	2C	,,
Holman, Hugh W.	2C	London
Hutchinson, Henry	1C	Liverpool
Keldie, Wm. ..	2C	N. Shields
Kirby, John S...	2C	,,
McCaig, Robert	1C	London
Mudie, Charles ..	1C	Liverpool
Nichol, Robert ..	1C	N. Shields
Shaw, James ..	1C	Sunderl'd
Shimmins, Paul .	2C	N. Shields
Simpson, Hugh	1C	Liverpool
Sims, Richard ..	2C	N. Shields
Wardle, Wm. Jas.	2C	Sunderl'd
Wilson, Henry B.	2C	,,

August 11th, 1888.

Davison, John ..	2C	London
Edwards, David	2C	Liverpool
Edwards, Jos. H.	2C	,,
Fraser, Robt. D.	2C	,,
Haws, Richd. C.	1C	,,
Jones, Hugh L.	2C	,,
Rowland, Jos. H.	2C	,,
Smith, Richard	2C	,,
Stanley, Wm. H.	1C	,,
Taylor, William	2C	N. Shields
Thornton, T. R.	1C	London
Walker, C. H.	2C	,,
Wallace, David	1C	Liverpool

August 18th, 1888.

Allan, W.	1C	Leith
Barron, Alfred ..	2C	Liverpool
Blackater, T. E.	2C	Greenock
Blundell, Edwd.	1C	Liverpool
Brookbank, W. J.	2C	N. Shields
Brown, Leonard	2C	,,
Dalkin, Jos. C...	2C	W. H'pool
Dawson, W. W.	2C	Hull
Dodds, William	1C	Leith
Ewing, Wm. ..	1C	Greenock
Frank, John	2C	London
Forsyth, George	2C	Leith
Gordon, Charles	1C	,,
Grant, Robert ..	1C	,,
Inglis, David J.	1C	,,
Inglis, T. McFarlane.....	2C	Greenock
Inman, G. M. S.	2C	Liverpool
James, William	2C	N. Shields
Jacobs, Thos. ..	2C	W. H'pool
Johnston, T. C.	2C	N. Shields
Logan, W.	1C	Greenock
Maillaid, Jas. D.	2C	N. Shields
McNicol, Wm...	1C	Greenock
McNie, Robert	1C	Leith
Remrow, John..	2C	Greenock
Reynolds, James	1C	London
Robertson, John	1C	Plymouth
Rose, Alfred....	1C	N. Shields
Smith, James E.	2C	Leith
Stewart, Wm. ..	1C	Liverpool
Topley, Joseph	2C	Liverpool
Waldridge, Alf.	1C	London
Watt, C.	1C	Leith
Watson, W. C. ..	2C	W. H'pool
Wickham, H. ..	2C	Leith
Williams, W. H.	2C	Liverpool
Weddowfied, Jno.	2C	N. Shields
Wootton, E. G.	1C	London

The Marine Engineer.

LONDON, OCTOBER 1, 1888.

EDITORIAL NOTES.

IT could scarcely be expected that the Trades Union Congress would meet and depart without giving a final kick to the proposed "Merchant Seamen's Widows' and Orphans' Pension Fund" Bill, which is not likely to become law during the Parliamentary Session of 1888 unless the seamen combine, deliberate, and work harmoniously and strenuously with the shipowners of the United Kingdom to procure the passing of a measure that will be alike satisfactory to all immediately concerned. A delegate at the Congress moved the following resolution, which was approved of by the meeting :—"This Congress is of opinion that the Merchant Seamen's Widows' and Orphans' Pension Fund Bill is absolutely unnecessary, as there is every facility for seamen to provide for their wives and families without this; and we view this compulsory scheme with alarm, as it tends to destroy that self-help, self-respect, and self-reliance which has enabled us to meet in Congress to-day, and, therefore, instruct the Parliamentary Committee to use every effort to prevent the passing of this Pension Bill." Of course, seamen, like most of us, possess every facility to provide for their wives and families in the event of the death of the bread-winner, but do they, or, we might say, do we embrace the present opportunities to the fullest extent? It must be admitted that while some do, the vast majority unhappily do not. Therefore, the Bill is not "absolutely unnecessary." An ounce of practice is worth a ton of theory. Further, the shipowners of the United Kingdom, who have so worthily taken the initiative in this important matter, are fully aware that the Legislature will not sanction a measure that the seamen do not gladly and willingly acquiesce in, therefore, the sting is taken out of the word "compulsory" and the equally absurd contention with regard to "self-respect," &c. Has not the so-called compulsory system been most successfully adopted and carried out in many branches of the public service, in addition to a large number of private firms? We fully admit that the Bill, as at present constructed, is not all that could be desired by the seamen, but if the cry was "all hands to the pumps," instead of "throw it overboard," it would be far more judicious. The scheme as proposed was for the benefit of the widows and orphans of those seamen who might have the misfortune to lose their lives in the execution of their duty. The contribution was to be 6d. for every ten days served on a ship's articles, which would amount to about 1s. 6d. per month, or, for twelve months, a little over 18s. The shipowners of the United Kingdom would add one-third to the amount paid by each man, and that would make the contribution 2s. per man per month. All seamen, except apprentices and lascars, on the ship's articles were to subscribe to, and receive the benefit of, the fund. The recipients were to be widows and children of British seamen, and the widows and children of foreign seamen who are resident in this country. It was not proposed that the men should pay anything to the fund when not employed. The fund was to be administered by a central committee in London, and by local committees at all outports where there was a shipping master. The committees were to be elected for three years, one-half by shipowners, and one-half by seamen, the latter's representatives to be elected by seamen's associations in the different ports; and the Board of Trade would have power to nominate one representative on each committee. If, after ten years' administration of the scheme, there was any surplus, it was to go towards forming a superannuation fund for aged and disabled seamen. These are the salient features of the Bill which the President and Vice-President of the Chamber of Shipping of the United Kingdom have so ably explained to the various meetings of seamen held at the principal shipping ports, and which now lies at Westminster awaiting its fate. A large number of objections have been made against the proposed measure, but the chief complaint appears to be the non-provision of a fund for aged and disabled seamen. This idea was originally contemplated by the promoters until an actuary pointed out that the revenue which would be required for the purpose would be enormous, consequently it was decided to lighten the ship by throwing over the superannuation fund until the course was clear. This system of overloading a Bill was one of the causes which wrecked the old Merchant Seamen's Pension Fund, established in 1747 and repealed by the Winding-up Act of 1851. The promoters of that unhappy fund attempted to extract half-a-crown out of sixpence. Not only was a man to be helped when he was injured, but his widow and children were subsequently to be helped. If he lost an eye he was to be helped, if he lost an arm he was to be helped, if he was injured in discharging or in loading cargo he was to be helped, if he was shipwrecked he was to be helped, in short, there were something like ten different cases in which help was given, and the result was that the fund broke down from sheer weight. The ship was made to carry too much. To have inquired

into the whole question, from the winding-up of the old fund down to the present day, and to have drawn up the best scheme that the combined experience of the past and collective wisdom of the present day can produce, must be pronounced most creditable to the promoters, whether the present Bill becomes law or not. It is certainly very peculiar that every leading maritime nation, except Great Britain, possesses some kind of a fund, or scheme, of a national character to help their aged and distressed seamen and their widows and orphans. The inhabitants of these islands, who, more than all other nations in the world, depend upon seamen for wealth, colonies, and commerce, are the only people who have no such provision. Of course there are a few societies struggling to do what they can to alleviate the mass of destitution and distress amongst seamen, their wives and families, but these excellent agencies are but as a drop in the bucket, and will remain so until there is a national compulsory system of contribution on a comprehensive and equitable basis. We hope that before Parliament re-assembles sailors will awake from their lethargic condition, and combine as one man to assist shipowners in passing a Bill whereby Jack may secure, if not a pension in his old age, some provision for those who are now left upon his decease to hazardous charity and a non-sympathetic world.

THE awful rapidity with which the modern iron vessel founders after collision or other serious injury to the hull naturally brings into prominence the means of safety for passengers and crew that are, as a rule, provided for such emergencies. There will be little doubt in all professional minds acquainted with the facts that the boat accommodation usually provided is nothing like adequate to provide an immediate and ready means of escape for passengers and crew in passenger vessels or for the crew in ironclads. Attempts have been frequently made, and are supposed to be carried into effect in the present time, for the supply of such deficiency by providing rafts, floating benches, and life buoys, to supplement the accommodation of the ordinary boats. But such apparatus would seem to be of little actual service in case of such a sudden disaster. The life-rafts never seem to be properly launched, and it would be but a poor escape to have to commit oneself to the sea with merely a life-belt to depend on, when it might be weeks before succour should arrive. The United States navy, through their secretary, Mr. Whitney, seem to have taken this question up more earnestly than has hitherto been done on this side of the water, and a board has been appointed, of which Captain Ramsay was made president, to investigate the life-boat question, so as to ascertain, if possible, whether they could supply conveniently to the vessels of the navy a sufficiency of life-boats possessing adequate carrying capacity and life-saving properties. They have found this, however, a very difficult task, and finally reported their want of success to the secretary. The secretary insisted, however, that some solution must be found, and re-convened a board. The board then, by a happy thought, thoroughly investigated the claims and advantages of the Berthon canvas collapsible boat, which, after due trial, they reported to combine the advantages of a good unsinkable life-boat, of great carrying capacity, in addition to its enormous advantages in the matter of stowing. It may be thought that in the hurry and confusion of a sudden disaster, such boats, if stowed away in a collapsed condition, would never be efficiently extended and launched in the case of such a desperate need. We, however, differ from this opinion. The Berthon boat is easily extended into its proper floating condition, and where it was known amongst the sailors that thoroughly reliable and seaworthy boats were ready to their hand with five or ten minutes' expenditure of labour to put them into order, after which from their lightness they could be so readily launched, we think in a panic the rush of the panic-stricken crew or passengers would be to the Berthon boats as readily as to the ordinary boats hanging from the davits. Where discipline could be maintained, as on a man-of-war or well-found passenger steamer, such boats could be readily and immediately got ready for the water. They would be less likely to be stove in than the ordinary timber boat, and would be infinitely more attractive for escape to both the passengers and the sailors than a raft or any such contrivance, which would be frequently washed by the seas. It would also usually fall to the fate of a raft, were it safely launched and loaded, that it would be left behind by the sailing or rowing boats which could so easily travel at three or four times the speed of the raft. In the case of the Berthon boats, they could well compete in speed with any of the other boats carried by the vessel. We are glad to see that in consequence of the report of the board one was procured for test and placed on the *Constellation*. It was given frequent trials during the cruise of this vessel, and is reported to have proved itself worthy of adoption for the use of the United States navy.

THE Manchester Ship Canal is making rapid and satisfactory progress under the able generalship of the well-known contractor, Mr. Walker. From Mr. Walker's

long experience in heavy contracts, he has been able to lay out his work with great judiciousness and splendid organization. He has divided the work into nine sections, on all of which work is proceeding with great rapidity, though it is evident that great exertions and organizations must be used to complete the contract within the four years stipulated, as about 150,000,000 cubic yards of excavation have to be moved and deposited before the works can be much advanced. Each section of labour has its own agent and its own staff of engineers, its own plant and workshops, and accommodation for the men. Mr. Walker deserves great praise for the consideration that he has taken for the comfort of the men working under him. Huts or rooms are provided in each section for workmen who may be suffering from accidents or illness. Two permanent hospitals have been built, and the labourers while laid up in hospital receive a proportion of their wages, this being provided partly by a deduction from wages from 1d. per day and the balance by Mr. Walker. Each section is worked and has a separate contract controlled by an agent-in-chief from the chief office in Manchester. A healthy spirit of rivalry is therefore promoted amongst the various concurrent contracts, both as regards efficiency and rapidity of work. The plant required for such a gigantic undertaking is enormous. Already 5,000 wheelbarrows, 3,000 wagons, 87 locomotives, and 65 excavating machines are provided,. and many more are still on order. Among the various excavators are 45 supplied by Messrs. Dunbar & Ruston, and in soft sand or loam 340 to 350 wagons are loaded in a day of ten hours by this machine. The Whittaker steam navvy is also coming largely into use, 11 of them being already in use. These navvies are worked from the bottom of the excavation, and a gullet or channel has to be provided for them by excavating with wagons, or by some other means. The delivery of these steam excavators is so great that the chief difficulty is to keep the machine well fed with empty wagons. Water, also, has to be kept down by pumping. Some German and French excavators are also already in use; and in contrast with the steam navvies, they work from the top of the slope on lines and rails. A train of wagons is placed under the machine, and as the train is slowly drawn along, the wagons are filled, and then are ready to haul to the tip. If space permitted a continuous train of empty wagons to pass under the excavator, there need be no delays, and a wagon per minute is easily filled, 420 wagons, loaded, representing a fair day's work. There are, at present, nearly 9,000 men on the works, and in certain places work is continued by day and night, the electric light and powerful oil lamps being in use. The output per month has reached 1,300,000 cubic yards, and this is still to be increased. Mr. Walker evidently goes on the principle that the best economy is obtained by the best materials, most trustworthy plant, as an overland temporary railway will be made from end to end, and is now completed but for the crossings of rivers and estuaries. The temporary roads are of the best character, 56-lb. rails being laid on sound sleepers, and fished. This is a most gigantic undertaking, and has been admirably put in hand by Mr. Walker, for whom it will be a great feather in his cap when satisfactorily completed, as we have no doubt it will soon be.

THE present activity in the United States Navy Department has given rise to many novel suggestions being submitted to it by various parties for the design and construction of new ironclads. A Mr. Thomas has proposed a design for a partially submarine craft, embodying the latest modifications in its armament. It is proposed to construct a *Monitor*, heavily armed, on the partially submerged system, leaving only the upper part of a turret visible, somewhat after the fashion of the Nordenfelt submarine boat. It is then proposed to arm this dangerous vessel as a ram, to effect the destruction of the hulls of opposing vessels under the waterline, and also the Ericsson submarine gun, which discharges a projectile filled with one of the high modern explosives, with ordinary powder, beneath the water, so as to strike the submerged portion of an opponent's hull. Further, for the turret fighting, it is proposed to arm it with the novel pneumatic dynamite gun, the power of which has been found to exceed that of ordinary ordnance. As this design and method of armament is strongly supported by Admiral Porter and others, it looks as if we are likely to see some novel departures in the construction of the future United States Navy. The result will be of great interest to ourselves.

THE loss of five lives, owing to asphyxia, on board the s.s. *Clan Macintosh*, is a startling notice of a new danger attached to the modern method of iron ship construction. Owing to the fragile nature of their iron shells, water-tight compartments have become a necessity, and the more perfectly this system of water-tight divisions in the bulkhead is carried out, the more reliable may the vessel be considered as protected against foundering. The consequence, however, is that with water-tight divisions and water-tight doors any gases generated in such compartments may become dangerous to life, either as

destructive to life merely as a noxious gas, or as highly explosive should they come in contact with a light. The light hydrocarbons exhaling from the coal bunkers or from a coal cargo have already given ample notice of their dangerous qualities by explosion and destruction of life. The catastrophe on the *Clan Macintosh* is the latest illustration as to the danger of asphyxia by reason of the accumulation of noxious gases. In one of the compartments above the screw tunnel in the *Clan Macintosh*, the food necessaries for the native crew, including a large quantity of rice, were stored; and such necessaries were practically hermetically sealed in their compartment, there being, however, a stop-cock communicating with the rest of the ship. On the opening of this stop-cock, a foul odour was found to issue from the store, which was easily recognised as carburetted hydrogen, which is inflammable. On Condy's fluid being used to check the foul smell, carbonic acid gas was produced, and the incautious descent of a considerable number of men to investigate the causes of the first foul smell resulted in the death of five of them, besides serious injury to eleven others. As neither the gases produced were of an irritant nature, but only narcotic in their action, had they spread unchecked throughout the vessel the whole crew might have been asphyxiated, or at least seriously injured, before conscious of danger. It seems obvious that wherever air-tight spaces are employed for storage they should be provided with ample and thorough ventilating apparatus, which should carry off all noxious gases as and when formed. This ought not to be difficult or expensive to arrange, as open communication or ventilation above the surface of the deck cannot in any way injure the water-tight character of the compartments.

THE SLOOP NYMPHE.—A serious and quite unprecedented misfortune has happened to the sloop *Nymphe*, which is completing for commission at Portsmouth. The vessel, which was laid down in July of last year, was only floated out of dock a few months ago. At the time the water was admitted the after and upper portions of the hull, as well as the rudder, were coppered, the ends of the propeller shafts to which the twin screws are fitted being covered with paint to prevent their rusting. When, last month, the water was pumped out of No. 1 Dock, whither the sloop had been taken to be prepared for her steam trials, by the Greenock Foundry Company, an alarming state of things was discovered. While she was in the ship basin the water seems to have percolated through the composition and set up a powerful galvanic battery between the copper and the steel. As a result, the exposed parts of the propeller shafting are seriously damaged, ruts an inch broad having been eaten out of the steel in some places as though gouged with a chisel. The key pieces are bitten away at the sides, while deep holes are everywhere visible. The propeller shafts are 45 ft. long, manufactured out of a single ingot, and the injury is so great that new ones will probably have to be fitted. Where the nuts screwed into the ends the threads are in a state of perfect preservation, and had the usual precaution of covering the exposed surfaces with zinc caps been followed no harm would have been sustained.

COPPER STEAM PIPES FOR MODERN HIGH-PRESSURE ENGINES.

By W. PARKER, Esq., Chief Engineer Surveyor Lloyd's Register of British and Foreign Shipping, Member of Council.

(*Concluded from page* 198.)

IT is well known that the structure of ordinary electro-deposited copper is purely crystalline, and easily disruptured under stress. The adjoining faces of the crystals, of which the whole mass is composed, appear under the microscope to be separated from each other, and have very slight cohesive power.

To describe more in detail how the decomposition of the unrefined copper is effected, and how the deposit takes place, I may state that the unrefined Chili bars are cast into slabs of the required length of the pipe, and these are arranged longitudinally in a wooden tank, in such a manner that the faces of the slabs are approximately at equal distances from, and parallel with, the surface of the cylindrical mandril, both at its sides and underneath it, leaving the upper side open for the burnisher to travel over. The mandril is fitted with a properly insulated spindle, running in insulated bearings, and driven by suitable wheel gearing, &c. The whole of this arrangement is immersed, as before stated, in a bath of sulphate of copper. The mandril forms what is termed the cathode, and the copper bars the anode, of the *electric circuit*. The cathode is connected with the negative pole of an ordinary dynamo machine, and the anode with the positive pole. When the dynamo is set in motion, an electric current passes through the solution, and the following chemical changes take place. The sulphate of copper is decomposed, and the sulphuric acid is transmitted to the anode, there to attack and dissolve or combine with a quantity of copper equal to that which has been liberated or deposited upon the cathode.

The electric terms used in this matter of the deposition of copper are like those for electroplating and electrotyping, and it may be as well to describe them here.

1st. The terms "cathode" and "anode" are synonymous with the positive and negative poles of an electric or galvanic battery.

Then to measure the volume of electricity passed between these points the term "amperes" is used as the unit, like feet or cubic feet, for measuring in the usual mechanical sense.

2nd. Then for expressing the force with which the volume of electricity is propelled the term "volt" is used as the unit.

3rd. The resistance opposed to the electricity is measured by "ohms."

4th. The work done in the electrical circuit is expressed by "watts," in the same way that in a steam engine the power developed is expressed by H.P. To put this shortly—

1 ampere × 1 volt = 1 watt
1 watt × 746 = 1 E.H.P.

These are the electrical terms employed by common consent in all European languages in connection with this science, and there are certain facts in relation thereto that are quite accepted.

The principal one to be noted here is that one ampere of electrical current will deposit ·005084 grain of copper per second per square foot of surface in a suitable bath and under fair circumstances. At the time I had the pleasure of witnessing the tubes being manufactured, the amperes and volts were measured by Siemen's standard instruments, from which, on the above basis, the quantity of copper electrically deposited in a given number of hours could be estimated.

In this way it was easy enough to judge of the H.P. transmitted through the dynamo to deposit a given quantity of copper or a given thickness of copper pipe of a given diameter. As to quality, it was by the nature of the process almost found to be uniform; but in this respect the photos of the magnified pieces of copper, both before and after the burnisher has been applied, and the mechanical tests I have made, are the best proofs. I may describe the latter as follows:—

Two of the four pipes I witnessed being manufactured I brought to London. One of these pipes I had fitted with strong flanges properly secured in an apparatus especially made for the purpose, and tested to destruction. The other pipe I had cut into two pieces, and one of these pieces, marked A, is on the table for inspection. The other piece was cut and flattened out

into a sheet, from which six test pieces were cut and prepared for making tensile tests. I also obtained from Messrs. J. Wilkes & Sons, of Birmingham, two solid drawn copper pipes of similar dimensions, and had them cut and tested in a like manner. The piece marked B is cut from one of these pipes.

In addition to these pipes I obtained from Messrs. Clelland and Thornburn, the well-known coppersmiths, of Glasgow, a brazed pipe of the same dimensions, made especially for my experiments, which was also tested to destruction, together with a sheet of best rolled copper, so that corresponding test pieces could be made to those made from the electro deposited pipe, and the solid-drawn pipe.

The results of these mechanical experiments are most interesting.

Pipe A, electro deposited, stood a pressure of 3,450 lbs. per sq. in. before it burst. The material stretched and the pipe expanded uniformly until the copper was reduced in thickness from $\frac{3}{16}$ of an inch to $\frac{1}{16}$.

Pipe B, solid drawn, stood a pressure of 2,200 lbs. per sq. in. It also expanded, but not with the some uniform character as pipe A.

Pipe C, brazed from sheet copper, also stood a pressure of 2,200 lbs. per sq. in., and burst as all brazed pipes do near the line of brazing.

The tensile strength and ductility of the copper cut from pipe A is given in the following Table:—

TABLE A.—Deposit Copper.

Marks on Specimen.	Dimensions in inches.			Tensile strain in tons.		Elongation per cent.		Contraction of Area per cent.	Remarks.
	Breadth.	Thickness.	Area.	Total.	Per sq. in.	In 8 in.	In 5 in.		
A 1	2·0	·175	·351	8·36	23·80	13·7	20·0	73	Electro-deposited copper cut circumferentially from the pipe.
A 2	2·0	·18	·36	8·36	23·22	13·0	17·5	68½	
A 5	1·0	·18	·18	4·32	24·00	12·9	16·0	82	Cut longitudinally with the pipe.
A 6	1·0	·18	·18	4·27	23·70	13·2	13·2	71	

The tensile strength and ductility of the copper cut from pipe B is given in the following table:—

TABLE B.—Solid Drawn Copper.

Marks on Specimen.	Dimensions in inches.			Tensile strain in tons.		Elongation per cent.		Contraction of Area per cent.	Remarks.
	Breadth.	Thickness.	Area.	Total.	Per sq. in.	In 8 in.	In 5 in.		
B 1	2·0	·195	·39	8·0	20·5	3·75	7·1	12·8	Solid drawn copper cut circumferentially from the pipe.
B 2	2·0	·195	·39	8·0	20·5	3·75	6·9	12·8	
B 5	1·0	·190	·19	3·8	20·0	2·90	7·0	43·6	Cut longitudinally from the pipe.
B 6	1·0	·190	·19	3·8	20·0	3·10	7·0	36·8	

The tensile strength and ductility of copper cut from sheet copper, such as would be supplied for making pipe C, is given in the following table:—

TABLE C.—Rolled Sheet Copper.

Marks on Specimen.	Dimensions in inches.			Tensile strain in tons.		Elongation per cent.		Contraction of Area per cent.	Remarks.
	Breadth.	Thickness.	Area.	Total.	Per sq. in.	In 8 in.	In 5 in.		
C 1	2·0	·265	·53	7·46	14·0	45·0	30·0	44·5	Rolled sheet copper cut in the direction in which it was rolled.
C 2	2·0	·265	·53	7·46	14·0	44·0	30·0	45·5	
C 5	1·0	·265	·265	3·72	14·0	45·0	35·5	31·0	Cut across the direction in which it rolled.
C 6	1·0	·265	·265	3·71	14·0	42·0	33·5	31·5	

It will be seen from these tables that the tenacity in the normal state of these three descriptions of copper—the electro deposited, the solid drawn, and the rolled sheet—are 23¾, 20¼, and 14 tons per square inch respectively.

The very superior ductility of the pure electro deposited copper is clearly shown by the manner of breaking, the elongation being chiefly confined to the neighbourhood of the fracture; and whereas the contraction of area at the fracture in the solid drawn copper is 12·8 per cent., and in the sheet copper 45 per cent., in the deposited copper it averages 72 per cent.

The tenacities shown by the test pieces are confirmed by the pressures at which the electro deposited and solid drawn pipes burst under hydraulic pressure, and, as before stated, the uniformity of the deposited material is very conspicuous.

In order to ascertain how deposited copper behaves as compared with solid drawn and ordinary sheet copper, and how its strength and ductile properties are affected by the action of heat, such as is contained in steam pressures that are now common, I have had a series of experiments made, the results of which are given on next page.

TABLE 2.

...ES OF TEMPERATURE OF DIFFERENT ... OF COPPER.

...	...	...	Temperature Fahr.	Remarks.
...	...	...	60°	Cold.
...	...	...	60°	,,
...	...	...	390°F.	Rolled sheet copper.
...	...	...	390°F.	
...	...	...	60°	Cold.
...	...	...	60°	,,
...	...	...	390°	Solid-drawn copper.
...	...	...	390°	
...	...	...	60°	Cold.
...	...	...	390°	
...	...	...	390°	Electro-deposited copper.
...	...	...	390°	

... in an oil bath while they were ... temperature of the oil being maintained ... the specimens were pulled ... given, which correspond with the ... pressure.

... are embodied in the preceding ... The electro-deposited copper, ... solid-drawn copper, stood about ... cold rolled sheet copper broke at ... temperature of 390° Fahrenheit.

... with the interesting series made by ... which I have before referred, and ... December 1887, I find there were ... tested at the same temperature, viz., ... cut across brazed joints, and others

... which had been cut across the brazed ... strength per square inch was 10·53 tons; ... from 8·59 tons up to 12·32, or about ... cent. above and 20 per cent. below the

... that were cut clear of the brazing broke ... strength of 11·81 tons per square inch, the ... 10·19 tons to 13 tons per square inch, or ... above to 10 per cent. below the average. ... with the experiments made by me at the ... the mean of four samples of sheet ... varying from 300° to 370° Fahrenheit,

... also go to show that ordinary sheet copper ... breaking strain of more than about 10 tons ... temperature of high pressure steam, apart from ... security arising from brazing which was so ... in the case of the *Elbe* and also the ... the electro-deposited copper, as also in ... pipes, these experiments indicate a breaking ... temperatures of about 15 tons per sq. in., or an ... and an absolute freedom from the dangers ... a step in advance for which I am sure ... will be grateful, and it comes none too soon, ... high pressures have here discovered a weakness ... found to cause anxiety.

... are now being made of larger diameter ... I am not aware what the limit of their process ... go to; at any rate, there is no limit to which ... electro-deposited pipes can be made. Many ... claimed for these electro-deposited pipes, ... investigated, but so far as steam pipes are ... that absolute uniformity of density, ... strength, and true circular section (all of ... qualities), can be obtained.

It is also established that copper deposited under a burnisher can be varied in tensile strength from the ordinary granular form to a material having high tenacity; and as it obviates the necessity for the steam pipes being put into the fire for brazing purposes, the strength and safety at high steam temperatures may be still further increased, and, if so, we shall, I am sure, be further gratified.

I cannot conclude this paper, which I hope may not be without interest to the members of this Institution, and to others engaged in the manufacture and use of copper pipes, without expressing my thanks to Messrs. Maudsley, Sons & Field for the great assistance they have been to me in carrying out a number of experiments, notably the bursting of the pipes, for which special appliances had to be devised, as also for the experiments at high temperatures; my thanks are also due to the Leeds Forge Company, who placed their testing machines at my disposal, and others who supplied me with copper and the necessary assistance and appliances for conducting these investigations.

ELECTRIC LAUNCHES AS PART OF THE EQUIPMENT OF OCEAN STEAMSHIPS.

BY FREDERICK WALKER.

IT has now become an established fact that electricity may successfully be employed as a motive power for small launches, although the application of the subtle elemental agent as a means of propulsion for large vessels is yet a problem, the solution of which lies in the future.

So long as we are forced to depend upon the conversion of heat into motion and power, and the conversion of the latter into an electric current, which is again reconverted into motion and power, we cannot consider that electricity can be cheaply utilised as a motive power for large and heavily laden vessels. The marine steam-engine of the present day has been so modified as to give the maximum of efficiency with the minimum consumption of fuel, and a nearly-perfect thermo-dynamic machine cannot be so superseded while the generation of a current of electricity depends primarily upon the conversion of heat into motion.

Water is a source of power and motion, a fact that was well known to man from the earliest period at which we have an authentic record of his work; yet water in a state of equilibrium is inert, and incapable of moving a feather. Now, if the equilibrium of water be disturbed, we may, by interposing suitable mechanism, obtain motion and mechanical work from the water in its natural effort to restore equilibrium. But this is simply a reconversion of force, or reaction of energy; for a certain power must have been expended in order to have first disturbed the equilibrium of the water; it may have been a natural force, such as a tidal wave, the ordinary action of the tides, or the process of evaporation and condensation by which our rivers and streams are supplied at a high level and do work in flowing back to the mean sea-level. And the effect of an electric current, and its conversion into light, heat, or power, is analogous to the example above mentioned. The equilibrium of the electricity that probably pervades all substances, animate and inanimate, must be disturbed before sensible effect can be produced; it may be disturbed by natural force, when the visible and actual effect is known as a flash of lightning, which is simply the instantaneous restoration of the electrical equilibrium of the solid earth and the surrounding atmosphere, igniting the molecules of matter held in suspension in the air during its progress, and displacing the air so violently that the sound-waves that are set in motion reverberate from side to side; or the electrical equilibrium may be disturbed by mechanical means, such as a dynamo-electric generator driven by a steam or gas engine, or any other suitable motor, and the restoration of equilibrium results in a current of electricity being set up in a circuit of predetermined conductivity doing work by the way, according to the nature of the interposed resistance, such as rendering the filament of a glow-lamp incandescent, maintaining an electric arc, or producing motion by causing the armature of an electric motor to revolve in a magnetic field. It is evident that, so far as our present knowledge of the subtle element allows of its utilisation as a motive power, it is simply as a *means of conveniently transferring the power derived from a prime motor, such as a steam-engine, to a place remote from such prime motor.*

In the case of applying electricity as a motive power for the propulsion of small vessels, it is convenient to make use of

accumulators or, as they are otherwise termed, secondary batteries or storage cells. It may be well at this stage to state that it is a popular fallacy to suppose that electricity can be "stored." The current of electricity used for "charging" a set of accumulators passes "through" the set of cells, and does work in them in the shape of chemical action, whereby the "energy" of the charging current is stored, or rendered latent within the cells, awaiting certain conditions, viz., the completion of an electrical circuit for a given time, to restore equilibrium by setting up another current of electricity.

A storage cell, such as are specially adapted for electrical launches, consists of a containing vessel—Fig. 1—which may be of teak, and lined with lead, the seams and joints being properly burnt. A number of plates of lead, are arranged therein in such a manner that each alternate plate forms one of a separate series to those upon either side of it, and these are separated, and prevented from actual metallic contact, by the interposition of insulating material. These slates are sometimes in the form of grids, and are coated or filled with an oxide of lead, preferably litharge, PbO, so as to present a large opposing surface between the two series of plates. There have been many inventions relating to the practical method of holding the oxide of lead within and in contact with its supporting frame of metallic lead, since the action of charging and discharging tends to disintegrate the mass of oxide, so that a slight concussion causes it to fall out, and, by bridging across two opposing slates of the series, cause a "short circuit," and render the cell in question inert, and a useless resistance in the set of accumulators. The Reckenzaun storage-cell has so far proved to be the best for all purposes where the cells are subjected to vibration or shocks, which is inevitable when employed for the propulsion of boats. One of these plates is shown in elevation and horizontal section by Fig. 2. It will be seen that the oxide is pressed into small cylinders, and disposed in the mould in such a manner that, when the melted lead is poured in, the cylinders are firmly held by the centre, yet exposing a large acting surface for the storage of energy.

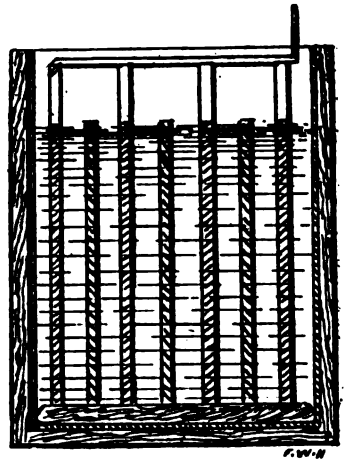


Fig. 1.

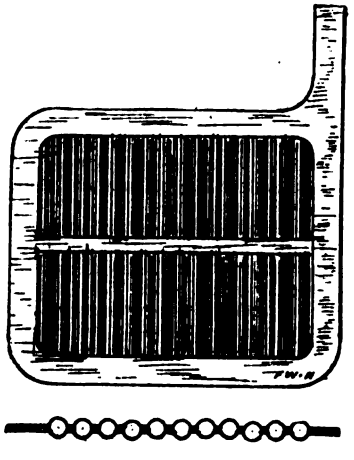


Fig. 2.

Fig. 3 shows the method of coupling up the two series of plates

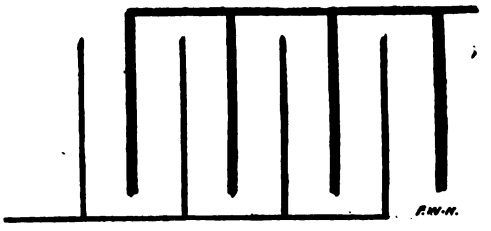
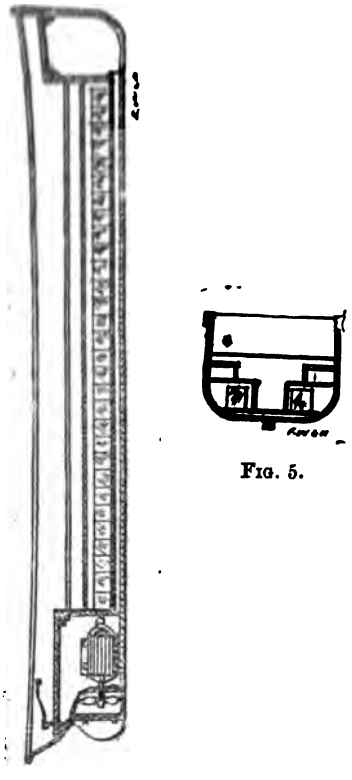


Fig. 3.

so as to form + and − terminals of the cells. The containing vessel is filled with sulphuric acid (H_2SO_4) and water, the specific gravity of the solution being about 1·150, or approximately one part of acid to ten of water, and the action of charging may be briefly described as follows:—

The first process of charging is termed "formation," and consists in simply passing a current of moderate strength through the cells. Immediately that this is done a counter-electromotive force is created, due to the internal chemical action upon the plates. The series of plates coupled to the positive (+) pole or wire of the generator become oxidised to a greater degree, while the oxide of lead upon the plates coupled to the negative (−) pole becomes reduced to spongy metallic lead. Repeated discharges and reversals of the poles is necessary to properly "form" the plates, and this may be briefly explained by stating that the oxidised + plate of one charging is more readily converted into spongy lead at the second charging, and this, again, affords a greater surface for the oxidation when again reversed. These reversals are repeated until the efficiency of the accumulator is practically high enough for ordinary work, when it increases until the maximum is attained. The peroxide of lead, which is formed by the charging current from the lower oxide, such as PbO upon the + plate, symbolised by PbO_2, is opposed to a surface of spongy lead, upon the cellular surface of which a considerable quantity of hydrogen is occulated. The resulting electromotive force of such a couple is about 2·243 volts, but this falls to a normal value during discharge of 2 volts. The superficial area of immersed oxide actually determines the storage capacity of the cells, and the rate of discharge should be very little greater than the charging current to obtain the highest efficiency of the accumulator. The rate of discharge, however, may vary considerably without seriously impairing the efficiency or the structure of the cells. Thus, the rate of charging may be 30 or 35 ampères, in which latter case 10 hours' charging may be reckoned as 350 ampère hours, although it would not be wise to discharge below 300 ampère hours, say at a rate of 50 ampères for 6 hours. The charging current should be adapted to the size of the plates, so that the free evolution of oxygen and hydrogen by bubbling is avoided, for it must be remembered that each cubic foot of hydrogen so liberated represents 65 ampère hours wasted, and similarly one cubic foot of oxygen will absorb energy represented by 130 ampère hours during evolution. Therefore, it is evident that an economic limit to the rate of charging is requisite, relative to the size and structure of the cells, and any attempt to hasten the operation of charging will result in waste of power, and also tend to disintegrate the plates. We have already stated that an electro-motive force E of 2 volts may be taken as the mean for each cell, therefore n cells in series (*i.e.*, coupled up + to −) will give a total E of $n \times 2$ volts. Therefore, in adapting accumulators for the propulsion of electrical launches, we must take into consideration the power that is required to be exerted by the electric motor, and also the length of time that such power is required to be in operation. The latter forms an important factor in determining the size of the cells; but the whole is, of course, dependent upon the capacity and build of the launch, and the speed at which it is required to travel. Fig. 5 shows a longitudinal section of an electrical launch that is suitable for forming part of the equipment of a large ocean steamer, and may be suspended from the davits in the same way as an ordinary boat, save that the running gear and hoisting tackle may be rather stronger and slightly elaborated in order to give greater facility for hoisting and lowering the launch.

The accumulators are shown in Figs. 5 and 6, ranged on both sides of the launch, the hull of which may be built of steel plates, and may be 30 ft. in length over all, and 6 ft. beam.



IG. 4.

FIG. 5.

FIG. 6.

A speed of from 8 to 9 knots per hour is sufficient for the ordinary service of the launch, and to attain this an electrical motor capable of delivering 5 mechanical horse-power upon its spindle is required. Allowing an efficiency of 70 per cent. this is equivalent to the absorption of 6·5 electrical horse-power, and we may calculate that this is required either constantly or intermittently for 5 hours. Allowing 60 cells coupled in series, and stowed on each side of the launch as shown, this gives an available electromotive force of $2 \times 60 = 120$ volts, and as we require 6·5 electrical h.p., the mean current will be

$$\frac{6{\cdot}5 \times 746}{120} = 40{\cdot}4 \text{ ampères,}$$

which for 5 hours is equivalent to a storage capacity of $40{\cdot}4 \times 5 = 202$ ampère hours, for discharge, and, making a further allowance of 30 per cent., this is equivalent to a charging capacity of

$$\frac{30 \times 202}{100} + 202 = 262 \text{ ampère hours.}$$

From the above data we may determine the area of the plates and the number of the + and — series in each cell, and also the external dimensions of the cells and the weight. This may be estimated thus—

Outer dimensions of cells.
Length 11½ inches.
Width 7¾ ,,
Depth 11 ,,

so that, as arranged, 30 cells on each side would occupy 24 ft. of the length of the boat.

The weight, inclusive of acid solution, would be $60 \times 80 = 4800$ lbs., or approximately 2 tons 3 cwt.

The electric motor is preferably coupled directly upon the propeller shaft, a flexible coupling being employed so as to avoid unnecessary friction at a high rate of speed by any fault in alignment, which may result from the packing or adjustment of the gland. The critical speed, or, in other words, the speed at which the highest efficiency of the motor is developed, would be probably 800 revolutions per minute; therefore, making due allowance for slip, the pitch of the propeller would be approximately 12 in. The practical utility of such a fine pitch was demonstrated by the performance of the *Volta*, an electrical launch built by Messrs. Stephens & Smith, which performed a double journey across the English Channel in September, 1886, a date that may yet become historical in the annals of marine propulsion. In this case the boat was 37 ft. in length by 6 ft. 10 in. beam, and the propeller was 20 in. in diameter and 10 in. pitch. An electric motor suitable for our typical launch would be about 14 in. in height, so that the deck, Figs. 5 and 6, may extend the whole length of the launch, and the accumulators and motors may be out of the way, and also invisible to the persons on board. An electric motor adapted for this purpose possesses many advantages over a steam-engine, not only in that it occupies but little space, but it also requires no attention while working, always provided that it is kept perfectly clean, that the brushes are properly adjusted upon the commutator so as to allow of a perfectly even wear, and also that an automatic supply of lubricating substance is maintained upon the two bearings. All these necessary precautions may be attended to while the launch is not in use, and the trap-door, or hatch, covering the motor need not be removed while working. There are several methods of reversing the direction of rotation of the armature of an electric motor, the system generally adopted consisting of two sets of brushes, arranged at opposite angles of the commutator, so that while one pair are resting upon the bars of the commutator, and affording an angular lead in one direction, the opposite pair are off, a lever bringing either pair into electrical contact with the commutator at will, and thus, by reversing the angular lead, the direction of rotation of the armature is changed.

Another system, equally effective, consists in varying the direction of the current around the field magnets. This is perhaps preferable, because the frequent moving of the brushes causes them to become disarranged, which results in sparking and a grooved commutator, and the lever is not so handy for manipulation as a switch. A single switch may be arranged, with contact plates marked "ahead," "astern," "stop," and the intermediate half-speeds. This variation of speed may be accomplished by coupling the cells in sections, so that a certain number are brought into action by each bar of the switch; or, as an alternative method, the coils of the field magnets may be wound in sections, and similarly connected to the bars of the switch. This method, however, is open to serious objections on the score of waste and impaired efficiency. Upon similar grounds the employment of artificial resistances, such as coils of German silver wire, or platinoid, introduced into the circuit is not admissible. The complete manipulation of the motor by means of a simple switch allows of an electrical launch being entirely under the command of the steersman, who can execute himself the manœuvring of the motive power, instead of passing orders to another person. We have shown that a launch of 30 ft. by 6 ft. may be used for five hours without recharging the accumulators, and it will, therefore, be appropriate to devote a short space to the operation of charging. The mean charging current for the type of accumulator before mentioned will be at a rate of 28 ampères, which, if exceeded, will entail waste of energy and probably a short life to the accumulator. We have seen that the charging capacity is 262 ampère hours, therefore the time taken for this operation at the proper current is

$$\frac{262}{28} = 9{\cdot}4 \text{ hours,}$$

say 9½ hours. This very fact is the source of all the disadvantages that have been attributed to accumulators when used as a means for the transference of power; but although 9½ hours seem at first sight to be a long period in which sufficient energy is stored to do but 5 hours' work, a little consideration will show the actual loss of power.

Presuming that the internal resistance of each cell is ·008 ohm between the + and — plates, the electromotive force required to overcome this resistance with a charging current of 28 ampères will be $28 \times {\cdot}008 \times 60 = 13{\cdot}4$ volts. Then the "back electromotive force" of the accumulators tending to set up a current in the opposite direction is approximately 2·3 volts per cell; therefore, with 60 cells in series the total electromotive force required is

$$13{\cdot}4 + 2{\cdot}3 \times 60 = 151{\cdot}4 \text{ volts.}$$

It is also evident that if, by the reduction of speed of the dynamo-generator, the electromotive force should fall below 138 volts, the accumulators will commence to react on the dynamo, and drive it as a motor. If the dynamo should be "series wound," the polarity of its field will become reversed, and the slowly revolving engine will simply act as a brake, and the result will be a "burnt-out armature," since the increase of temperature will be so great as to destroy the insulation. Hence series-wound machines

should never be used for charging accumulators. A "shunt" dynamo will simply act as a motor and assist the engine at the expense of the energy stored in the accumulators until the electro-motive force becomes increased by an increase of speed, when the charging will be continued. A "compound wound" or self-regulating dynamo, such as are generally employed for incandescence lighting on board ship, will serve as a charging-machine, provided that the "series" coils of the compound winding be maintained by a separate current, such as a couple or three accumulators, care being taken to ensure the proper direction of the exciting current around the field magnets. In some cases, however, the series coils are so arranged that the magnetic influence of them upon the field magnet coil is not sufficient to cause a reversal, although the power of the shunt coils may be partially neutralised thereby.

It rarely happens, however, that the ordinary electrical lighting plant fitted to an ocean steamship allows of an electro-motive force of 138 volts.

It is a simple matter, therefore, to arrange the charging terminals on board the electric launch in such a manner as to couple the accumulators in "multiple" or "parallel," for charging, in two sets of 30, although they are still coupled for discharging in series through the motor. This will necessitate the employment of a switch, with double contact bars, in the charging circuit. Then, in order to maintain the requisite current, since the former total resistance of ·480 ohm is now divided into two distinct circuits, the total resistance becomes $\frac{\cdot 240}{2} = \cdot 12$ ohm, and 28×2 ampères requires 13·4 volts plus $30 \times 2 \cdot 3 = 82 \cdot 4$ volts. This allows the ordinary ship's dynamo to be utilised in the daytime for charging the launch accumulators, and maintaining them ready for action. In the Eastern trade, where electric launches will be found most useful, the light is rarely required in the daytime, while in the Western Ocean, where thick fogs and dull days frequently occur, and the light is required for the convenience and comfort of the passengers, such a launch would not be required during the voyage.

Recurring to the actual loss of power during the transference of energy in our typical launch, we will take the last-mentioned example.

56 ampères × 82 volts = 6·1 electrical H.P., which must be exerted for 9½ hours. In order to estimate the "mechanical" H. P. for comparison, we must approximate the work done upon the crank-shaft of the engine driving the charging dynamo, adding 20 per cent. for this purpose, which is a fair allowance for the electrical loss in the dynamo, friction, and transmission, and brings the total to 7·3 mechanical H.P. for 9½ hours, representing 69·3 H.P. hours. The mechanical work obtained for 5 hours upon the shaft of the screw propellor of the electric launch is equivalent to $5 \times 5 = 25$ H. P. hours, so the ratio is as follows: $\frac{\text{Useful work}}{\text{Total work}} = \frac{25}{69 \cdot 3} = \frac{25 \times 100}{69 \cdot 3} = 35$ per cent., showing that the total loss between the engine driving the charging dynamo and the propeller shaft of the launch is 65 per cent. This looks at first sight to be extremely extravagant, but upon consideration the actual utility of an electric launch as compared with a steam launch of equal dimensions and power will show the great advantages possessed by the former.

1st. The stowage of the accumulators and motor under the deck, leaving the whole space fore and aft perfectly clear for passengers and luggage, as compared with the cumbrous engine and boiler, which, in a small launch of this type, must needs occupy a third of the passenger room of the boat.

2nd. The absolute cleanliness of the electric launch, which is free from smoke, soot, and grease.

3rd. The ease with which one person may manœuvre the boat, since the controlling switch and the tiller or wheel may be so placed in juxtaposition that one man, acting as steerman, may also act as engineer, so far as the manipulation of the engines is concerned.

4th. Presuming that the motor and accumulators are periodically overhauled, and care is taken to preserve the insulation and perfect contacts of the one, and the free lubrication of the other, the mechanism requires *no* attention while in use.

5th. By systematically charging the accumulators by the ship's dynamo when it is not required for lighting, the electric launch is ready for any emergency that may arise during a voyage, and the power may be applied directly the boat is lowered from the davits.

6th. The actual power absorbed during the operation of charging is really of small moment, since the donkey boiler or main boilers of an ocean steamer are always under steam, and the exhaust steam is passed either into the condenser or into a tank, and the loss of fresh water is practically negligible. The loss of 65 per cent. shown by the foregoing example is really balanced in point of actual cost by the fact that no auxiliary boiler is required, nor fuel for the same, nor a stoker for the same, and there is no loss of time in getting up steam when the launch is required for use.

At the numerous ports touched by steamships engaged in the Eastern trade, and particularly during transit through the Suez Canal, an electric launch would prove a valuable adjunct to the equipment of a vessel, and its practical utility would compare greatly in its favour with a ship's boat manned by a Lascar crew, pulling out of time and order, and becoming confused under circumstances requiring sharp decisive action. The ease and facility with which a hawser could be taken ashore in the Canal, either when a ship has taken the bank or is going in "gare," by the electric launch would prove to be a strong recommendation in its favour. It has been alleged that an electric launch is practically useless in a slight seaway, because the acid solution, or electrolyte, contained in the secondary cells is thereby spilled, and of course corrodes the hull of the boat. Now, in the first place, the whole of the interior of the hull should be well painted with asbestos paint, this being acid proof, and this merely as a precautionary measure, in case that one of the cells should be accidently stove in. An escape must be provided for the gases evolved, or the accumulation of pressure would eventually burst the containing vessel; but such safety outlet may be arranged so as to retain the liquid, while releasing the gases under slight pressure. A small vulcanite pipe, formed with an internal annular ridge to act as a valve seat, upon which a vulcanite ball is held by the compression of a small india-rubber cylinder, would act perfectly as a safety valve under these circumstances. The cells should also be firmly braced so as to retain them in position without unduly straining the electrical connections from cell to cell. The buckling, disintegration, and short-circuiting of the plates, which sometimes take place, are merely structural defects which have been eliminated in the latest designs of accumulators for this purpose, which is shown by Figs. 1 and 2 in the first part of this paper. In designing an electrical launch for the above purpose, the mean current during discharge through the motor should approach as nearly as possible to the safe charging current in order to attain the highest efficiency, and arrangements should be made and a system established of keeping the cells charged, daily compensating the slight leakage of current that inevitably takes place.

While a heavy metal, such as lead, is employed for the storage of energy, and such storage requires a prime motor of proportionately greater power, we cannot hope to accomplish more in the way of marine propulsion by electricity than by applying it to a small launch, yet, considering the practical value of the latter as part of the equipment of an ocean steamer, and the comparative economy in maintenance, we may look forward to the time as not far distant when every large steamer will carry electric launches at her davits, thereby facilitating many necessary operations in the course of a voyage in times of peace, and adding to her capability and usefulness as an armed cruiser in times of war.

A NEW SHIPYARD TO BE STARTED AT MIDDLESBROUGH.—A few years ago the Tees-side Iron and Engine Works Company, Limited, laid down a splendid shipbuilding yard at Middlesbrough, but for various reasons operations were never commenced at the establishment. The yard has now been leased to Messrs. Raylton Dixon & Co., of the Cleveland Dockyard, Middlesbrough, at which establishment for many years magnificent ships of every type have been constructed. Messrs. Dixon have a great number of orders on hand, and they do not intend to lose any time in commencing operations at the new yard, at which place they expect to find employment for over 1,000 hands. This firm already employ upwards of 2,000 hands at their Cleveland Dockyard.

SHIPBUILDING ON THE THAMES.—An order has been received by the Thames Iron Works and Shipbuilding Company from the Admiralty for the construction of a fast cruiser to be named the *Blenheim*. This cruiser is 375 ft. long, 65 ft. beam, and 1,000 tons displacement. She is to be fitted by Messrs. Humphreys, Tennant & Co. with triple-expansion twin-screw engines of 20,000 I.H.P. for a speed of 22 knots, and will carry coals sufficient for a voyage of 15,000 knots at a speed of 10 knots per hour, and will be an important addition to Her Majesty's Navy. This company has also recently completed Her Majesty's ship *Sanspareil*, a turret ironclad of 10,470 tons displacement.

THE LAW CONCERNING MARINE ENGINEERS IN CONNECTION WITH SHIPPING CASUALTIES.

IN the number of the *Marine Engineer* for July, 1884, we published a long and critical article upon the "Law on Board of Trade Regulations concerning Marine Engineers." We will now notify the other important part in the law relating to them, namely, that which applies to them respecting shipping casualties, and which applies to their incompetency, misconduct, and punishment.

By the Merchant Shipping Act Amendment Act of 1862, the power vested in the Board of Trade of cancelling or suspending the certificate of marine engineers was discontinued, and vested in and to be exercised by the Local Marine Board, magistrates, Naval Court, Admiralty Court, or other court or tribunal by which the case is investigated or tried, except in the instance provided for in the fourth paragraph of the Merchant Shipping Act of 1854, which is that "if he is shown to have been convicted of any offence." Complaints were made to the Royal Commission appointed in 1873 to make inquiries with regard to the alleged unseaworthiness of British registered ships, and other matters connected therewith, against the then-existing mode of conducting inquiries respecting shipping casualties; and the Commissioners reported that the tribunal before which they were made "did not command public confidence, as the mode of prosecution was said to be dilatory and expensive, while the power of the court was ill defined and in some cases could not be enforced." The Commission recommended several important alterations in the constitution and procedure of the Inquiry Courts, which were carried into effect by the Merchant Shipping Act, 1876, and the Shipping Casualties Investigation Act, 1879. By the former statute a Wreck Commissioner was appointed, whose duty it was, at the request of the Board of Trade, to hold any formal investigation into a shipping casualty, "and for that purpose he shall have similar jurisdiction and powers as are conferred on two justices of the peace by the Merchant Shipping Act of 1854, and all the provisions of the Merchant Shipping Acts, 1854 to 1876, with respect to investigations conducted under the 8th part of the Merchant Shipping Act, 1854, shall apply to investigations held by a Wreck Commissioner." By the appointment of such an officer more critical and more satisfactory investigations and adjudications were expected to follow, as he would be a person known to be well acquainted with the *rationale* of judicial evidence and therefore more capable of presiding at inquiries concerning shipping casualties than justices of the peace or members of Local Marine Boards.

In order, however, to ensure the most careful and practical inquiries into these casualties, in the interest of the public as well as the parties immediately concerned in them, provision is made by the Act that a formal investigation into a shipping casualty, held before a Wreck Commissioner, justices, or other authority, shall be made with the assistance of an assessor or assessors of nautical engineering or other special skill or knowledge, to be appointed from a list of persons for the time being approved for the purpose by a Secretary of State. This list includes four classes, viz., (1) mercantile marine masters of five years' service holding a certificate of competency; (2) mercantile marine engineers of the same number of years' service holding a first-class certificate of competency; (3) officers in the Royal Navy of the rank of admiral or captain and three years' service in command of one of Her Majesty ships at sea, or the rank of staff commander and three years' service in that rank in one of Her Majesty ships at sea; (4) persons of nautical engineering or other special skill or knowledge possessing (*a*) such qualifications as the Secretary of State considers requisite in ordinary cases, and (*b*) those having such qualifications as this Cabinet Minister considers necessary for special cases.

According to the law and rules for appointing these assessors, if any shipping casualty investigation "involves, or appears likely to involve, the cancelling or suspension of the certificate of an engineer . . . . there shall be appointed from the list not less than two assessors from class 1 and class 2, or from either of these classes. Subject to any special appointment or appointments which the Secretary of State may think it expedient to make in any case where special circumstances appears to him to require a clear departure from these rules, assessors as regards inquiries as to the competency or conduct of marine engineers shall be appointed as follows:—Where the investigation involves, or appears likely to involve, the cancelling or suspension of the certificate of an engineer, one at least of the assessors shall be appointed from class 2."

The Board of Trade informs the Secretary of State when and from which class assessors should in their opinion be appointed, but the Board must not request the appointment of any individual assessor. In every instance of investigation one assessor at least must agree in the report, or the officer's certificate cannot be cancelled or suspended. When there is a Local Marine Board and a stipendiary magistrate is a member of such board, all investigations are, whenever he happens to be present, to be made before him. It appears that a Local Marine Board is put in action by the Board of Trade when an engineer has misconducted himself, but in those instances in which there has been no loss of life or damage to the ship in which his misconduct was manifested. A Local Marine Board may suspend or cancel the certificate of competency or service of any engineer if, upon investigation, he is reported to be incompetent, or to have been guilty of any gross act of misconduct, intoxication, or tyranny.

The choice between the Wreck Commissioner, stipendiary magistrate, and justices to hold formal investigations into shipping casualties is exercised by the Board of Trade. We are informed in Murton's "Wreck Inquiries," 1884, "that having regard to the purpose for which a Wreck Commissioner was appointed, as declared by the Legislature, the Board of Trade have always assigned as many inquiries as possible to be heard by him. He holds all investigations which take place in London, and also proceeds at the request of the Board of Trade, when necessary, to any part of Great Britain to hold an inquiry. If the case cannot be heard by the Wreck Commissioner, then in places where there is an experienced stipendiary magistrate the investigation is committed to the latter. Occasionally it is impossible or inexpedient owing to the special circumstances of the case, or to the engagements of the Wreck Commissioner, to assign the inquiry either to him or to a stipendiary magistrate. It is then held before justices, but such instances are comparatively infrequent. In Scotland, however, there are no stipendiary magistrates whose services are available for inquiries, and they are held either before the Wreck Commissioner, before justices or a sheriff or sheriff's substitute. Under Section 501 of the Merchant Shipping Act, 1854, in Ireland cases are frequently remitted to stipendiary magistrates, and failing these to justices, by whom, however, no inquiry has been held for many years." The appointment of the Wreck Commissioner being for the United Kingdom, he is empowered to exercise jurisdiction in Ireland. He has not, however, apparently been required to hold an investigation there. With regard to investigations in Scotland, the Board of Trade may remit the same to the Lord Advocate to be prosecuted as he may direct, and the person or persons ordered by this legal official to conduct such investigations have similar powers to two justices or a stipendiary magistrate in England.

The Wreck Commissioner may suspend or cancel the certificate of competency in service of any engineer, when upon investigation conducted under the provisions of the Merchant Shipping Act, 1854, it is reported that the loss or abandonment of or serious damage to any steamer or loss of life has been occasioned by his wrongful act or default. Now an engineer has been held by the Wreck Commissioner to have been guilty of a wrongful act or default, under the statute, on account of the following conduct, viz.:—neglecting to see that the sea-cocks were properly closed; neglecting to test the density of the water in the boiler; neglecting an incrustation of salt formed on the top of the furnace, on account of which it collapsed; neglecting to examine the pistons and other parts of engines; neglecting to maintain proper discipline in the engine-room.

"In every case," says the solicitor to the Board of Trade in his "Wreck Inquiries," "the degree of culpability attaching to all these acts must be estimated according to the circumstances in which they were committed. Under one set of conditions they may be venial, while in another they may be inexcusable in a man of ordinary prudence and intelligence."

(To be continued.)

ORDER FOR A GOVERNMENT TUG.—An order for a large twin-screw tug, somewhat similar to H.M.S. *Hearty*, built by the same firm, has been secured by Messrs. W. B. Thompson & Co., Dundee, from the Indian Government. The tug will have triple-expansion engines of 2,000 I.H.P., and it is calculated that she will attain a speed of twenty knots an hour.

DIRECTING THE FIRE OF MACHINE GUNS DURING NOCTURNAL WARFARE.

WITH the present and ever-increasing high rates of speed attained by torpedo boats it has become a matter of the utmost importance, especially during a night attack, that no time should be lost in opening a vigorous and effective fire, from the vessel about to be attacked, on the rapidly advancing foe.

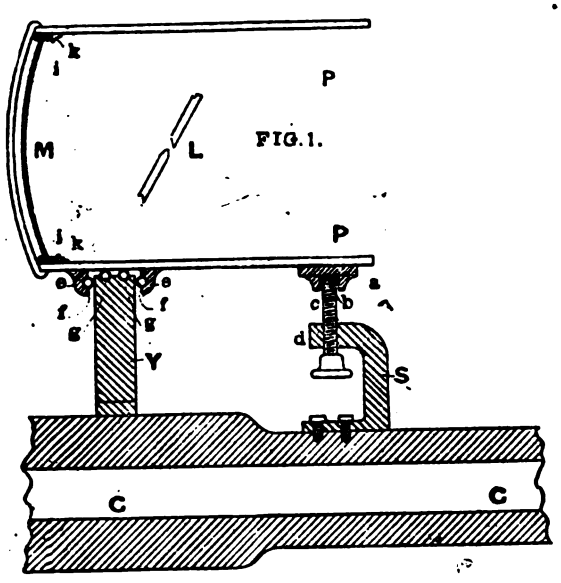
As is well known, the present method of repelling a night attack of torpedo boats is to seek them out by the aid of the search light, and then, having got the beam of a search light on the attacking boat, to bring the machine gun or guns, as the case may be, on it and open fire.

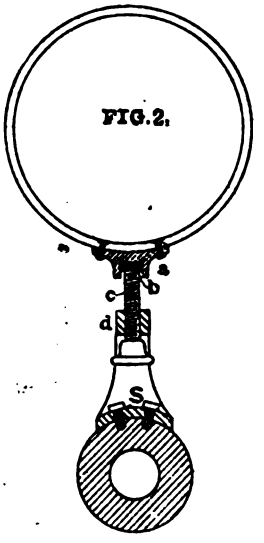
Now, this method has two, at least, distinct disadvantages. First, having got the boat within the beam of light it is a difficult matter, moving rapidly as she is, to keep her sufficiently evenly illuminated to allow of a good aim being taken at her; and, secondly, which is even of more importance, there is a perceptible loss of time (and that too at the most critical moment, when the torpedo boat, finding by the light that she is discovered, will either launch her missile or, figuratively speaking, "take to her heels," and so escape) between getting the light on a boat and laying a gun on her.

It is to do away with these disadvantages, and to allow of an effective fire being opened on a torpedo boat immediately she is sighted, that Messrs. W. T. Goolden & Co., 2, Victoria Mansions, Westminster, S.W., have brought out the arrangement which we have pleasure in herewith illustrating, and from which it will be seen that the act of aiming is done with the light itself; hence immediately the light is thrown on to an object at any distance the gun is simultaneously and automatically directed to the same spot, and fire may be instantly opened and maintained. In the accompanying drawings the gun G has mounted upon it the standards S and Y, carrying the light-protector P, fitted with the electric arc lamp L and mirror M.

The rear standard Y, as shown by Fig. 3, half embraces the projector P, and is prevented from transmitting the shock of the discharge to the projector by the india-rubber pieces *f*, *g*, while similarly, and for the same purpose, the thick disc or pad of india-rubber *b* is interposed between the front part of the projector *a* and the head of the elevating screw *c*, which passes through the threaded orifice *d* in the standard.

To further prevent any injurious shocks being transmitted to the mirror M, it is carried in a thick rubber packing ring *i*, *i*, which in turn is secured in place by the brass ring *k*, *k*.





It only remains to say that, as shown, the projector is set so that its axis coincides with that of the gun, this adjustment sufficing for absolute point-blank range, any desired deviation from this range being attained by raising or lowering the screw *c*.

The whole of the mountings can be readily unshipped and the gun left in its ordinary condition for day service.

With this adjunct the powers of a rapid-firing gun, both for offence and defence, are enormously increased, and we trust the invention will meet with the recognition which it well merits.

NEW CLYDE YACHTS FOR NEXT YEAR.—Not for several seasons has there been so much talk about new boats for next year as there is at the present time. For a certainty a new 60-tonner, two 20-tonners, and a new 10-tonner, all built up to and in advance of the latest racing requirements, will be added to the racing fleet of next season. These yachts will of course be built under the Y.R.A. rating rule, and their appearance means a new spurt in the 20 and 40 ton class, which has for some years been rather in abeyance. It is more than rumoured that a second 60-tonner will be added to the list, in which event this class will be re-established, with *Yarana* and *Petronella* enabled to race in their own class instead of racing against boats of about twice their tonnage, like *Irex*. It will be acknowledged that better promise for the sport has not been heard for some years; and with rumours that the Clyde 6-tonners Y.R.A. rating is to be added to, and the 17-foot L.W.L. have additions made to their numbers, the season of 1889 does promise to be a lively one.

MESSRS. S. OWENS' & CO.'S EXHIBITS AT GLASGOW EXHIBITION.

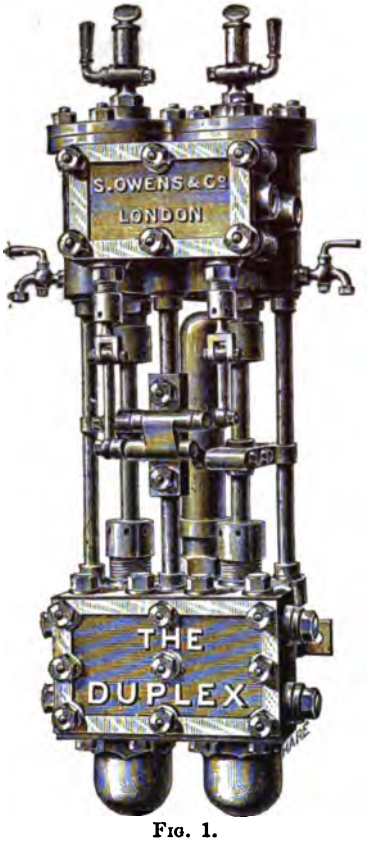


Fig. 1.

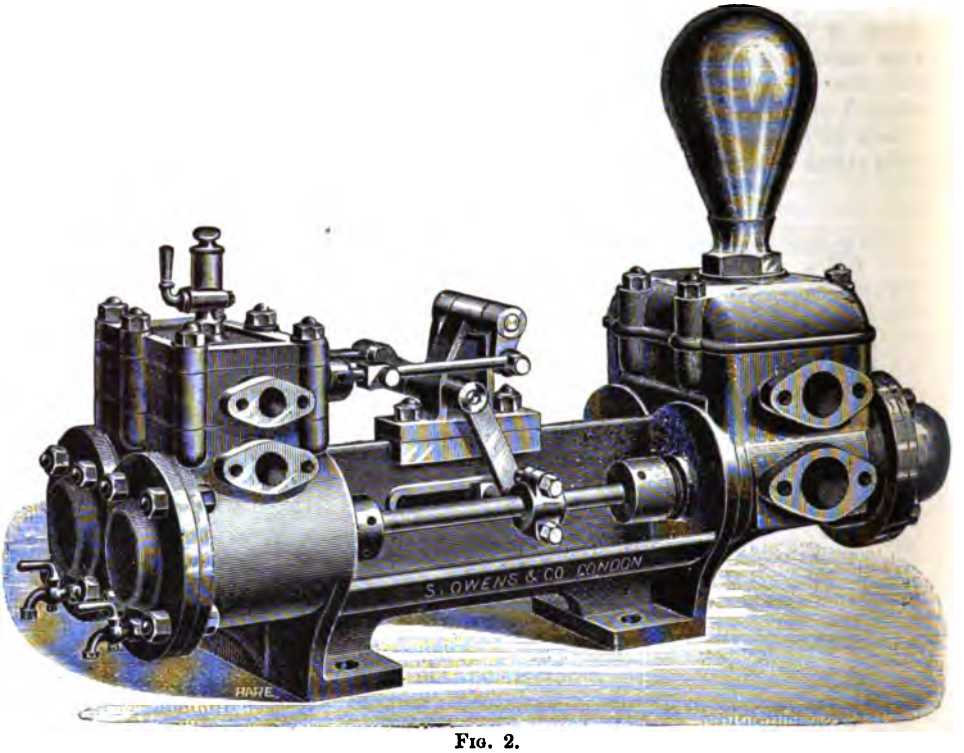


Fig. 2.

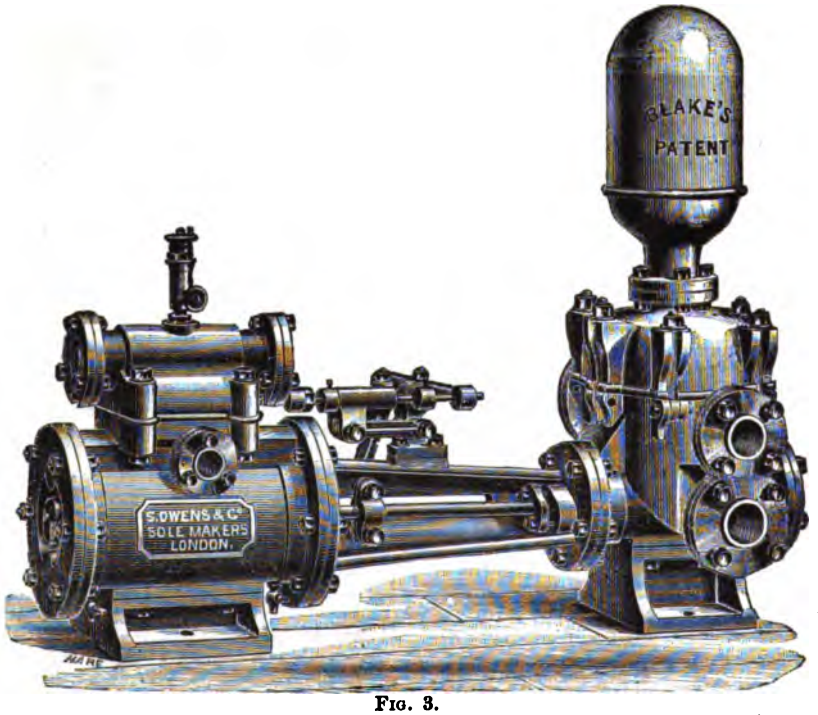


Fig. 3.

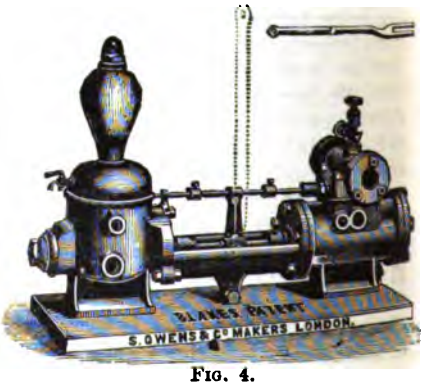


Fig. 4.

MESSRS. S. OWENS & CO.'S EXHIBITS AT THE GLASGOW EXHIBITION.

THE well-known firm of hydraulic and general engineers whose name stands at the head of this article, make a very fine display of their leading types of pumps and other specialities at the Glasgow Exhibition. We have selected for illustration here a few of the firm's exhibits which are most likely to be of interest to our readers; but as illustrations at the best give no idea of the *quality* of the article they represent, we would strongly recommend our readers to pay a visit of inspection to the firm's stand at Glasgow, or to their works in London, when we are sure they will be perfectly satisfied with the firm's productions both as regards workmanship and materials, and, what is perhaps of more importance, simplicity of design and efficiency of action.

The vertical marine pattern of "Duplex pump," shown in Fig. 1, is provided with gun-metal pump-end, and has internal packed plungers. These plungers have been specially designed for use on board ship, and have been supplied to steamers, cruisers, launches, torpedo-boats, etc. By operating the slide-valve of one steam cylinder from the piston-rod of its neighbour, a regular and even discharge of water is produced, while the pistons pausing at each end of their stroke allow the pump valves to close without shock or concussion, and, as will be seen from the illustration, the valves are readily accessible for repairs or renewal.

The firm stock this pump in sizes ranging from an approximate delivery of 600 gallons to 12,000 gallons per hour; larger sizes are also made as required.

An equally well made and designed pump is the "Horizontal Duplex," shown in Fig. 2. This is usually made in sizes ranging from a capacity of 600 to 16,000 gallons per hour; while special sizes of all designs, and either simple, compound, or compound-condensing, are made according to requirements. The smaller sizes are specially adapted for boiler-feeding and the work of small pumps generally; while those of larger capacity are employed for hydraulic work, oil line pumping, loading and discharging oil in petroleum steamers, fire-pumps, and other purposes.

The firm also exhibit various types of Blake's patent direct-acting steam pump, of which they are the sole licensees and manufacturers for Great Britain. Perhaps the best testimony we can give as to the value of this pump is to simply state that upwards of 20,000 of them are in use. Fig. 3 shows the general arrangement of this form of pump as designed for raising large quantities of water to moderate heights; while Fig. 4 shows a special design for boiler-feeding or forcing water under heavy pressure. This latter type, of which five sizes are exhibited, is made of capacities varying from 200 to 40,000 gallons per hour, the three smaller sizes being fitted for working by hand or steam, as shown. We trust, in an early issue, to illustrate the valve arrangement of the "Blake" pump in detail.

Messrs. Owens also exhibit a large model of Lacour's patent direct-acting steam pile-driver, of which they are the sole licensees and manufacturers for the United Kingdom. The steam pile-driver has been used for driving the piles for the Ramsey Iron Pier, the Clyde Trust, River Wear Commissioners, Aberdeen Harbour Commissioners, etc.; and in every case has given the utmost satisfaction. We propose, in a future issue, illustrating and describing the Lacour steam pile-driver more fully.

Some well-made gas valves, boring tools, etc., are to to be found on this firm's stand, and with this necessary brief description we must close our somewhat inadequate notice of a very interesting contribution to the Glasgow Exhibition.

ELECTRIC RIVETING AND DRILLING AT THE GLASGOW EXHIBITION.

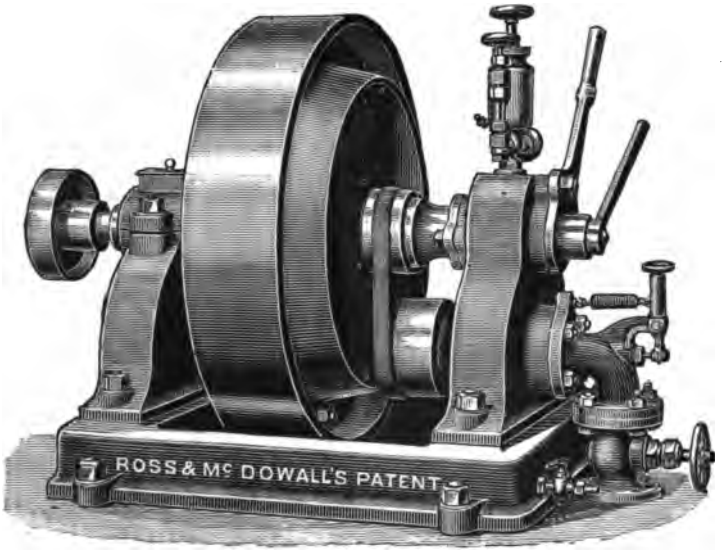
MR. F. J. ROWAN'S exhibit in the machinery section shows several novel and interesting examples of the application of electricity to the holding and working of machine tools; and it seems probable that we may witness an extensive development of the system at no very distant date, as there can be little doubt as to its many advantages. Many interesting attempts have been made to introduce mechanical appliances for the riveting of heavy ship-plating. The conditions of the work involve the separation of the striking portion of the apparatus from the bolster or holder-up, while, on the other hand, the process of riveting requires that the two portions of the machine should be firmly held together. In consequence of these conflicting requirements the application of machine riveting has not hitherto made much progress. The use of electro-magnets for the purpose of attaching the machine to its work satisfies the requirements in a very complete way. It gives a rapid method, practically instantaneous, of fixing the riveting portion of the machine to the work, and leaves no rivet-holes to be afterwards filled by hand. The bolster or holder-up is as quickly attached on the other side of the plating. When the magnets are properly arranged on opposite sides of the plating, with the two poles of unlike denominations facing each other, they are drawn towards each other, thus pressing the plates together and ensuring the proper condition for riveting. The effect of bolting the two portions of the machine together through the rivet-holes is thus obtained without any attendant drawbacks; and the distressing work of holding-up can be reduced to a minimum. The motive power for producing the striking action of the riveting hammer is derived from an electro-motor attached to the framing of the holding magnets. This motor is geared to a cam which, when the current is applied, draws back the hammer against a powerful spring. When at the highest point of the cam's rotation, the spring is released and a heavy blow delivered on the rivet. This action is repeated about 150 times a minute, and the force of the blows may be regulated as required by adjusting the tension of the spring. The application of the same principle to drilling, tapping, and other tools is also shown, and the inventor is of opinion that the application to drilling is even more important than to riveting, and is capable of a wider field of employment. The electro-magnetic drilling-machine consists of two powerful holding magnets enclosed in a frame. The drill works between the magnets, which are placed a short distance apart. A small electro-motor is attached to the side of the magnet-frame, and by means of suitable reducing gear rotates the drill when the current is applied.

These machines have been practically tried, with

most satisfactory results, for both ship and boiler work. Mr. Rowan has arranged his exhibit in such a manner as to allow of actual demonstration of the working of the different tools. A steel structure, representing a portion of the side of a 2,000-ton ship, built to Lloyd's classification, has been erected at his stand, and the machines are suspended against the face of this by adjustable slings depending from pulleys running on a light traveller bar bolted to the top of the plating. The slings serve to sustain the weight of the machines, while the current is switched off the magnets during the operation of passing from point to point in the progress of the work. All the appliances are self-contained, and only require the conduction of the electric current by wires or cables to enable them to perform the operations for which they have been designed. The workmen are exposed to no danger in handling the machines, as a current of about 60 volts is sufficient to work them; and it is well known that continuous currents of up to 150 volts potential are quite harmless. The drilling and riveting machines are frequently shown in motion, the electric current being obtained from a dynamo in an adjacent stand.

THE "ROTA" ENGINE.

THE production of an efficient rotary engine has occupied the attention of inventors from the earliest days of the steam engine. The "Rota" engine, which we illustrate in our present issue, is the latest and perhaps the most successful development in this direction. This engine, which is the invention of Messrs. Ross and McDowall, has been designed specially to attain a high speed of revolution with a relatively slow piston speed, and the patentees appear to have accomplished this object in a highly satisfactory manner.



The engine consists of a narrow cylindrical casing of cast iron with closed sides, mounted on a shaft supported in two standards, one on either side of the cylinder. The shaft is hollow, and has ports for the admission and eduction of steam, the interior space being divided longitudinally to form admission and exhaust passages. A cylindrical boss is fitted eccentrically upon the shaft within the casing, the inlet and exhaust ports passing through it to the working steam spaces. This construction does away with any passages which can remain filled with steam after cut-off has taken place—a fruitful source of waste in ordinary engines. Inside the main casing, and concentric with the box, is fitted a cylindrical ring, the annular space between it and the boss being partially filled by a series of segmental pistons. The pistons are held in equal angular positions relatively to the axis of the main casing, to which they are connected by means of slides working in radial slots formed in the casing; and as their distance from the axis varies according to their position round the eccentric boss, their distance apart also varies, those pistons bearing on the boss, having least eccentricity, being close together, while those on the opposite side are further apart. As the pistons travel round the eccentric boss their speed is highest at the point of greatest eccentricity, and the ports are arranged to admit the steam between each pair of pistons just after they pass the point of least eccentricity, and to exhaust as they pass the point of greatest eccentricity of the boss. The steam, however, can be cut off at any desired point, and will expand while the piston is impelled forward at a greater relative velocity than that following it, so that the intervening space becomes greater until the line of greatest eccentricity is reached, and the exhaust from between that pair of pistons takes place. Each succeeding piston, as it comes round, is acted on in like manner, and a continuous rotary motion is thus imparted to the outer casing, the inner ring being free to rotate with it, and accommodating itself by sliding within the main casing to the radial sliding movement of the pistons relative to the axis of the casing. The central hollow shaft is held stationary, while the main casing forms a fly-wheel revolving upon it; but with reversing engines the casing is attached to the bed plate, the shaft alone revolving. A motor of the latter type is shown by Messrs. Glen and Ross, who are the makers of these engines, at their stand in the machinery section, driving a screw propeller; while a second engine has been fitted in the Exhibition to drive a 48-in. "Blackman" fan. This engine has run at 600 revolutions per minute for the past month, starting at 10 a.m. and working till 10 p.m. without any attention to it in the way of oiling, &c.

The "Rota" engines will start in any position, as there is no dead point, and will run up to 1,000 revolutions per minute with absolute steadiness, as there are four steam-chambers, a heavy fly-wheel, and all moving parts being in perfect equilibrium. The patentees furthermore claim for their motor that it works with less friction than any other engine, great durability on account of the small number of working parts, none of which are exposed, and the slow piston speed and economy of steam due to an early and quick cut-off. The engines occupy little space, have a neat appearance, and seem well adapted for all purposes where high speed and moderate power are required.

MESSRS. JAMES HORNE & Co., 20, Redcross Street, Liverpool, have been appointed agents for Evan's Patent Boat-lowering Apparatus, M'Collin's Patent Boat Davits, The "Porteous" Hand and Steam Steering Gear, and The Patent "Duplex" Feed-water Heater.

"NOMOS."

THE necessity for protecting ships' bottoms against the natural accumulations which induce fouling is now universally recognised; and, in accordance with the economic law which says that whenever a need arises the means to meet it will not long be found absent, a great number of specifics are now in the field competing for pre-eminence in battling against the evil.

Last month, when noticing the exhibits of Messrs. Mungo Gray & Co. at the Glasgow Exhibition, we omitted to state that a specimen of the celebrated "Nomos" composition was shown with others on the same stall. We may now mention, however, that not only is the composition shown on the stall named, but its utility is practically illustrated to all visitors by being used on the bottom of the small steamer *Thrush*, which, as most of our home readers know, runs short trips on the Kelvin water in the Exhibition grounds. Among the qualities that are claimed for "Nomos" are,—reasonableness of cost, rapidity in drying, and smoothness of surface. These are qualities that cannot fail to be appreciated; but, as characteristic of a paint for ships' bottoms, they would be comparatively valueless if united with them was not also to be found that quality of preventing impure accumulations which is the essential principle required in such a paint. That "Nomos" possesses that quality in a very special degree, is amply demonstrated by the following facts, the authenticity of which is unquestionable. The Guion liner *Nevada* was this year partly coated with "Nomos," the object being to test it against another composition with which the vessel's bottom was also partially covered. The vessel was docked at Liverpool, after a voyage, on August 13th, and it was then seen that, though the other composition used was slimy and to some extent worn off, "Nomos" was clean and intact. In the process of "washing down," the brushes took away every particle of the former composition, but made no impression upon the latter. The steamer *Birkhall*, which, after a long voyage, was docked at Sunderland on July 10th, was also made the subject of a competition. In this case it was found, that the part of the vessel which was coated with the composition matched against "Nomos" was thickly covered with barnacles, while the part coated with the latter was almost free from those unsightly attachments, and was in other respects almost perfectly clean. On August 17th, the ship *Amoy*, which had been fully coated with "Nomos," was docked at Glasgow after having been seventeen months afloat. On examination no barnacles were found on her bottom, and though the hull below water was of a greenish colour, owing no doubt to the presence of an incipient growth of marine vegetation, which, however, was scarcely perceptible, the paint was in good condition. During the past two months several vessels belonging to the Wilson line (Hull) were re-coated with the "Nomos" composition, after having ran for periods ranging from six to twelve months. A number of steamers belonging to other ports have also been re-coated, some of them having ran for twelve and even fourteen months. The number of repeat orders that are being received by the manufacturers (Messrs. R. T. Bruce & Co., Hull) are indeed, without other proofs, sufficient to show that "Nomos" is steadily gaining in the estimation of shipowners and others who have opportunities of observing the good results produced by its use.

MESSRS. A. TURNBULL & CO.'S EXHIBITS AT THE GLASGOW EXHIBITION.

A REALLY good collection of minor appliances relating to marine engineering is shown by Messrs. A. Turnbull & Co., St. Mary's Works, Glasgow. Amongst these we note a number of dead-load equilibrium safety valves, single and double, for stationary boilers; spring-load safety valves for marine, locomotive, portable, and launch boilers; combined high pressure and load-water safety valves; combined spring and dead-load safety valves, spring protectors, self-acting boiler-feed regulator, and miscellaneous boiler fittings. We shall not comment on the quality of these articles—the reputation of the firm for first-class workmanship renders such comment unnecessary, though we cannot refrain from remarking that the entire collection is one of the most representative of its kind inside the Exhibition buildings.

MR. D. S. PORTEOUS' EXHIBITS AT THE GLASGOW EXHIBITION.

MR. DUNDAS S. PORTEOUS, of Sundown Engine Works, Paisley, exhibits specimens of Evans' boat-lowering apparatus, and of McCollins' boat lowering appliance. Mr. Porteous has besides several descriptions of steam steering gear on view. Every item in this exhibit is of the most modern type, and all seem admirably adapted for the purposes for which they have been constructed. Mr. Porteous, we might add, manufactures, at his works at Paisley, cloth and thread finishing machinery, also wood-working and potter's machinery.

FORGE WORK AT SUNDERLAND.

MESSRS. J. L. THOMPSON & SONS, Sunderland, having, by extensions and the laying down of modern plant, brought their shipbuilding establishment to a point of effectiveness that is not surpassed, if it is equalled, anywhere, have, within the past few months, directed their spirit of enterprise into a new channel. The forge at Pallion, which formerly was worked by Messrs. Bainbridge & Co., came into Messrs. Thompson's hands towards the close of last year, and has since been so altered and improved that it is now capable of turning out about double the quantity of work in a given time that could have been completed, under similar circumstances, in former years. Many important alterations, all of which were undertaken with a view to facilitate production, have been carried out in the forge itself; but the most interesting change effected in the place has been the addition of a new fitting-shop, in which the forgings, whether for use as structural parts of ships or engines, receive the finishing touches to fit them for being placed in the positions assigned to them. The greater part of the machine tools in the fitting-shop, among which may be mentioned a powerful boring-mill and a plane of a new and peculiarly useful type, have been supplied by Messrs. Scriven & Co. of Leeds, and they are undoubtedly very creditable examples of those makers' productions. It is contemplated to further extend the establishment by the addition of another smith's shop; and when this is done the output, which at present is much larger than that of any other forge in the district, will, of course, be greatly increased. Up to a recent date the firm have been exclusively occupied with forgings for use in their own shipbuilding yard, or in the engineering works of Mr. John Dickinson. They have, however, just turned out a large stern-frame for a shipbuilding firm at Hartlepool; and when the additional smith's shop already spoken of is erected, they will no doubt enter more largely into competition with other forge proprietors in the North.

LAUNCH OF THE MELPOMENE.

ON Thursday morning, September 20th, the protected cruiser *Melpomene*, which has been advanced with great rapidity, was launched from the building slips at Portsmouth. Although the public were admitted, as usual, to view the proceedings, there was no accommodation provided, as the Admiralty are understood to object to the expense of providing stands. A small booth was erected at the stem for the convenience of the persons immediately concerned in the launch, while officers were admitted alongside the ways on the production of their cards. The customary religious service was read by the Rev. C. J. Corfe, chaplain to the dockyard, and the ceremony of christening was performed by Miss Carpenter-Garnier, daughter of Mr. Carpenter-Garnier, of Rookesbury-park, formerly member for South Devon. The ship had been partly set up on the previous day, and completed on the morning of the launch; and punctually at the time fixed—half-past 11—Miss Carpenter-Garnier severed the lanyards suspending the dogshores by means of a chisel and mallet, and the ship glided into the water, the initial inertia being overcome by a little hydraulic pressure.

The *Melpomene*, the keel of which was laid down as recently as the 10th of October last year, is twin ship to the *Marathon* and *Magicienne*, recently built and launched by the Fairfield Shipbuilding Company at Govan, and a sister ship to the *Medea* and *Medusa*, launched and building at Chatham. They compose the squadron of swift cruisers ordered by the Admiralty last year, and with their great speed are admirably adapted either for scouts or for the protection of commerce. They are new types of ships, designed by Mr. W. H. White, the Director of Naval Construction at the Admiralty, and are wholly destitute of side armour, depending for their powers as fighting vessels upon the position of their vital parts, their speed, and the ease with which their guns can be manipulated. In dimensions, protection, armament, and all other qualities, the "M" class are practically the same, but in the *Medusa* and *Medea* the steel bottoms are coated with antifouling composition, and vertical triple-expansion engines have been fitted, special arrangements of armoured coamings being worked for the protection of the cylinders. The three remaining ships, on the other hand, are wood sheathed and coppered, so as to make them capable of remaining afloat for long periods without serious fouling and consequent loss of speed; and are propelled by horizontal engines placed entirely below the protective deck, which extends from stem to stern, and shelters the boilers, magazines, steering gear, &c. These modifications have involved a slight increase in displacement and a loss of a quarter of a knot in *maximum* speed, and are accepted in view of the special services for which the vessels are intended. It is, however, questionable whether, given the same amount of power developed by the engines, there will ensue any decrease of speed, save upon the measured mile at the beginning of their career, since the hulls of the coppered ships will always be free from weeds and incrustation. The *Melpomene* measures 265 ft. in length and 42 ft. in breadth, and has a depth of 23 ft. Her freeboard is 12 ft., and when fully equipped and loaded with coal and stores she will have a mean draught of 17 ft. 6 in., and a displacement of 2,950 tons. The hull is built of Siemens-Martin ⅜in. steel, covered with two thicknesses of teak. The stem, which is formed as a ram, is a phosphor-bronze casting, and is sustained in the rear by the protective deck and framework of the ship. The stern-post and shaft brackets are also made of the same material, and were cast in the dockyard. The life of the *Melpomene* is mainly defended against the projectiles of an enemy by a steel turtle deck, 2 in. thick in the sloping parts at the sides and 1 in. where it is horizontal. This deck is placed 4 ft. below the water-line, and from its position and contour it is held that any shot striking it would be deflected upwards and over the bulwarks. The safety of the ship, however, is further insured by the double bottom and the coal bunkers, which are disposed all along the sides above the protective deck, and by the fact that the skin of the vessel is subdivided to such an extent as to form no fewer than 75 watertight compartments, 12 of which, composing the double skin, are capable of being used for water ballast. The engines, which are to be provided by Messrs. Palmer & Co., of Jarrow-on-Tyne, are of the triple-expansion type, and are to be of the collective power of 9,000 horses, or 4,500 to each set, and to run at 140 revolutions per minute when driving at her full speed of 19¼ knots. Steam will be generated in cylindrical multitubular boilers, having a total fire-grate area of 460 square feet of heating surface, and which can be used with or without forced draught as occasion requires. The triple-bladed propellers, as well as all the under-water fittings and valves, are made of gun-metal. Auxiliary engines, fire-engines, pumps, and Downton pumps have been fitted, as is usual in ships of war. The *maximum* amount of coal carried is 400 tons, which it is estimated will enable the ship to steam 8000 knots at a speed of 10 knots. Both hand and steam steering gear will be fitted, and when in action the machinery, steering arrangements, and the firing of the torpedoes will be under complete control in the conning towers forward and aft. The armament of the *Melpomene* will consist of six 6 in. breechloaders on Vavasseur's central pivot mountings, two carried in sponsons on the upper deck, two on the poop, and two on the forecastle, and all possessing great firing range; nine 6-pounder quick-firing and three Nordenfelt machine guns. The vessel will also carry six torpedo tubes, four of which are fixed on the broadside, and the others forward and aft, and all above the water-line. She will be lighted throughout internally by electricity, about 200 incandescent lamps being required for the service. Search lights are also to be fitted, one on the conning tower forward and two in sponsons on the upper deck aft. Sails will only be carried for steadying purposes in a gale, and the masts will have no military tops. The work of building has been carried out by Mr. W. H. Malpas, Assistant Constructor, under the immediate supervision of Mr. W. J. Fitze, Constructor, and Mr. H. E. Deadman, Chief Constructor. The total cost of the *Melpomene* is estimated at £153,642.

STEAM TRIALS OF H.M.S. SANS PAREIL.

ON September 20th and 22nd the armour-plated battleship *Sans Pareil*, which was launched by the Thames Ironworks and Shipbuilding Company at Blackwall on the 9th of May last year, made highly satisfactory trials of her engines at the Nore, under the superintendence of Mr. Robert H. Humphrys, of the firm of Messrs. Humphrys, Tennant & Co., of Deptford, who are the manufacturers of the machinery for this and many of the other great battleships of the English Navy, and have just received the contract for providing the engines for the *Blenheim*, of 20,000 guaranteed H.P., a 22-knot cruiser, the order for which has been placed with the Thames Shipbuilding Company. The trials of the *Sans Pareil* were under the superintendence of Commander Kelham (in the absence of the captain of the Medway Steam Reserve), Staff Commander Symons, of the *Pembroke*, being in charge of the navigation of the ship. Among those present on the occasion were Mr. R. J. Butler (who represented the Admiralty), Messrs. Hill, Hayward, and Mackrow, of the builders' firm; Mr. J. H. Ferguson, Chief Inspector of Machinery; Messrs. Andrews and Crocker, of Chatham Dockyard; and Mr. Cantor, fleet engineer of the ship.

The *Sans Pareil* is in every respect a sister-ship to the *Victoria*, built by Lord Armstrong's Company on the Tyne, and launched by Mrs. Forwood, while her engines, which were steamed by Messrs. Humphrys, Tennant & Co. last June, are of the same triple-expansion type; that is to say, the ships are the quickest and most powerfully armed, and, with two or three exceptions, the heaviest battleships in the service; or, to descend to particulars, it may be desirable to state briefly that they measure 240 ft. by 70 ft., have a displacement of 10,470 tons, carry a brace of 10-ton guns in their single turrets, and are armoured to the thickness of from 16 in. to 18 in. at the sides, and 16 in. at the bulkheads, while the turrets are constructed of 18 in. compound plates. The engines are contracted to develop 12,000 horses under forced draught, and are designed to propel the vessels at a speed of 17 knots when exerting their *maximum* power; while in consequence of the triple-expansion principle, the consumption of fuel is so small, comparatively, that the 1,200 tons of coal which their bunkers are capable of stowing will, it is estimated, be sufficient to enable the ships to steam 7,000 knots, or from England to New York and back, at the rate of 10 knots. When, therefore, we take into consideration the number of the mechanical moving parts and reciprocations, the enormous boiler pressure (135 lb.) to be generated and controlled, the exceptional power to be developed, and the weight of the bulk to be moved through the water, it is impossible not to be struck by the perfection to which modern engineering skill has attained, when those in charge of the machinery can regard the steam trial under natural draught as a mere preliminary spin round, or preparation for the crucial run with closed stokeholds; and when, after allowing one day for

sweeping tubes, they can proceed to sea the next morning and greatly exceed the contract power, without, as it were, so much as turning a hair. This was what was achieved in the two instances of the *Victoria* and the *Sans Pareil*. The last mentioned vessel left the Nore at half-past nine on Thursday morning, September 20th, for four hours' continuous steaming with open stokeholds, the following being the mean results of the trial:—Steam pressure in boilers, 133·57 lb.; vacuum, 27½ in.; port and starboard revolutions, 87·37 and 86·86 per minute; I.H.P., 4,109·76 (port) and 3,929·66 (starboard), giving a collective I.P. of over 8,000. This total was more than 500 horses in excess of the contract, the mean speed of ship, as measured by patent log, being 16 knots.

The more important trial, with closed stokeholds, came off on Saturday, September 22nd, under very favourable auspices as regards the weather, the five hours' run, with regard both to the sea and to the working of the machinery, being of the character of a pleasure trip. The *Sans Pareil* was immersed to a mean draught of 26 ft. 9 in.—her sea-going trim—by water and iron ballast, so that the conditions of the steaming may be regarded as of a practical character. The ship got under way at 9.15 in the morning, and in the short space of half an hour, everything going well and with an abundance of steam, the contractors were ready to begin the official observations, of which the following are the hourly returns:—

Revolutions.		Indicated Horse Power.		Collective Power.
Starboard.	Port.	Starboard.	Port.	
100·5	100·0	7,177·16	7,126·99	14,304·15
101·4	101·6	7,363·04	7,469·21	14,832·25
101·6	101·6	7,264·94	7,396·43	14,661·37
99·8	100·0	7,060·82	7,072·49	14,133·31

The means of the observations gave the following *data*:—Steam pressure in boilers, 130 lb.; mean air pressure in stokeholds, 1·9 in. of water; vacuum in condensers, 26 in.; mean revolutions, 100·76 starboard and 100·7 port; mean I.H.P., 7,216·49 starboard and 7,266·28 port, being equal to a collective power of 14,482·77. Extraordinary as were the results achieved at the trial of the sister-ship, the trial of the *Sans Pareil* not only confirmed but surpassed them. For, while the power developed at the trial of the *Victoria* gave an excess of 2,244·54 beyond the guarantee, the mean collective power indicated by the *Sans Pareil* showed a gain of no less than 2,482·77 above the contract. The average speed realized on the occasion was 17·75 knots. On the conclusion of the run the *Sans Pareil* was circled to port and starboard, and the engines were tested for stopping, starting, and going astern, with very satisfactory all-round results.

COMPRESSED FUEL.

AN anxious problem with coal merchants in London and the provinces, as well as upon the seaboard, has long been that of the disposal of the dust or slack from their coal, which in some cases has accumulated to the extent of several hundred tons, and is still accumulating. Attempts have been made from time to time to solve this problem, but without any apparent practical success. Now, however, there appears to be a reasonable chance of the question being settled in a satisfactory manner by the aid of a briquette making machine which has been invented by Mr. Mowll and Mr. Messenger, C.E., of Dover. There are already several machines extant for making patent fuel bricks for steam purposes, but among other drawbacks incident to them, the machines are too large and costly for use by coal merchants, while they produce blocks of fuel which are much too large for use by the public in general. The new machine which we recently saw in operation at Creek Bridge Wharf, Greenwich, is of comparatively small size, and the briquettes made by it measure only 4½ in. long by 2½ in. wide, and 2½ in. deep, and weigh 1½ lb. each. In making these briquettes the coal dust is first mixed with 10 per cent. of crushed pitch, and the mixture is fed into a vertical mill in which the ingredients are thoroughly incorporated by stirrers. At the bottom of the mill the ingredients encounter a jet of steam which melts the pitch and brings the mixture into a plastic condition. The mixture is then fed into a revolving mould and the charge receives its initial pressure from a horizontal plunger. The mould then makes a partial turn, and the partially compressed charge encounters another plunger which gives it the final pressure. Another partial turn brings the compressed charge to an ejector which pushes it out of the mould into a trough, from which the briquettes are removed by a boy on to a tray to be taken away for stacking. The briquettes are ready for use in about an hour from the time they have been delivered from the press. The action of the machine is continuous, the operations of moulding, pressing, and ejecting being carried on simultaneously by means of the rotary mould block. The rate of ordinary working is about 14 briquettes per minute, or 5 tons per day of 12 hours, which can be increased to 6 tons if necessary by working at a higher speed. The machine can be erected at a comparatively small cost, and can be worked by unskilled labour. It can be driven either by horse or steam power, so that its services are available where steam is not to be had. The result of the burning of this fuel in ordinary grates was shown to be very satisfactory, a good bright fire being maintained without trouble and with but very little ash. The machine is being introduced by the Universal Patent Fuel Machine Company, of 32, Fenchurch Street, London.

CONSTRUCTION OF FRENCH CRUISERS.

FROM a summary, published by the *Yacht*, dealing with construction of cruisers built and building for the French navy from 1886 up to the present time, either in the navy yards or ordered of private shipbuilders, we learn that their number is 12, although originally more were planned, and that they comprise three classes. Beginning with cruisers of the third-class, we find that of this kind, the representative type of which is the *Forbin*, three (*Forbin*, *Surcouf*, and *Coetlogon*) were built from designs by M. de Bussy, inspector-general of shipbuilding, and three (*Troude*, *Lalande*, and *Cosmao*) from designs by the Société de la Gironde. *Forbin* was built at Rochefort Arsenal, *Surcouf* at Cherbourg, *Coetlogon* by the Société Transatlantique, and the three remaining by the Société de la Gironde at Bordeaux. The principal dimensions of the first three vessels are:—Length between perpendiculars, 95 metres; extreme breadth, 9·30 metres; depth of hold, 6·54 metres; draught of water amidships, 4·24 metres; total displacement, 1,848 tons. An armoured deck, four centimetres thick, extends over the whole of the vessels, whilst below is a splinter deck, which protects all the vital parts. The propelling machinery consists of two horizontal direct-acting compound engines, supplied with steam from six cylindrical boilers, placed in three separate compartments. The engines are to develop with forced draught 6,000 I.H.P., and to propel the vessels at a rate of 19½ knots an hour, with 140 revolutions of the engines. At a speed of 10 knots the available coal supply would enable the vessels to make a run of 2,400 miles. The *Troude*, *Lalande*, and *Cosmao* differ but little from the above three vessels. The engines are still under construction. The six cruisers are each to be armed with two 14-centimetre guns, three 47-millimetre quick-firing guns, and four revolver guns.

Of cruisers of the second-class two different types were proposed. One type, including the *Davout* and *Suchet*, was designed by M. de Bussy; the other, the *Chanzy*, was to be constructed to the designs of the Société de la Lovie. The construction of the latter was countermanded owing to the want of money, as a portion of the 26,000,000f. voted for the cruiser fleet was absorbed by the deficit in the marine budget. The third-class cruisers *Lalande*, *Cosmao*, and *Coetlogon* could not be withdrawn from the building programme, because the contracts had been ratified by Admiral Aube just before his retirement. The more useful vessels, *Chanzy* and *Mogador*, had to be sacrificed, while the less valuable ones were commenced. The *Davout* and *Suchet* were built at Toulon Arsenal, their engines at Indret. The principal dimensions of those cruisers are:—Length between perpendiculars, 88 metres; extreme breadth, 12·30 metres; depth of hold, 5·25 metres; draught of water amidships, 5·35 metres; displacement, 3,027 tons; engines, 9,000 I.H.P.; expected speed, 20 knots. With their supply of coal they will be able to steam 4,000 miles at a speed of 12 knots an hour. Their armament consists of four 16-centimetre guns, four quick-firing guns, and six 37-millimetre revolver guns.

The cruisers of the first-class comprise three types. The first type is represented by the *Alger*, from the designs of M. Marchal; the second by the *Jean-Bart* and *Isly* from the plans of M. Thibaudier; the third type by the *Dupuy-du-Lôme*, designed under the supervision of M. de Bussy. The *Alger* is of the following dimensions:—Length, 105·60 metres; extreme breadth, 13·80 metres; depth of hold, 9·30 metres; draught of water

amidships, 5·50 metres; displacement, 4,123 tons. This vessel is building at Cherbourg. Her engines, of 8,000 I.H.P., are being constructed at Creusot. They are expected to propel her at a speed of 19 knots. The *Jean-Bart* and *Isly* have the following dimensions:—Length, 105·40 metres; extreme breadth, 13·28 metres; depth of hold, 5·60 metres; draught amidships, 5·74 metres; displacement, 4,123 tons. Their engines, of 8,000 H.P., building at Indret, are to give the cruisers also a speed of 19 knots. The *Dupuy-du-Lôme*, the largest and most powerful of the cruisers of the first-class, is, as a protection against melinite shells, armoured throughout, and of the following dimensions:—Length, 114 metres; extreme breadth, 15·76 metres; depth of hold, 6·90 metres; draught of water amidships, 7·07 metres; displacement, 6,297 tons. She will have three pair of engines, of a collective I.H.P. of 14,000, with which she is expected to reach a speed of 20 knots. She will be very heavily armed, with two 19-centimetre and six 16-centimetre guns, four 65-millimetre and four 47-millimetre quick-firing guns, and eight 37-millimetre revolver guns. All the cruisers of the first-class are, of course, protected by an armoured deck.

According to the *Yacht*, the condition of the rapid cruiser fleet of the French navy, if the two large battery cruisers *Tage* and *Cécille* are included, is satisfactory; but the French Nautical paper adds that it would have been better if the *Forbin* and *Surcouf* cruisers of the third-class only had been built, and, in place of the four others of the same class, the second-class cruiser *Chanzy* and the first-class cruiser *Mogador* had been constructed.

DEEPENING OF BIRKENHEAD DOCKS.

AT the weekly meeting of the Mersey Docks and Harbour Board, on September 6th, Mr. Alfred Holt moved that the following recommendation of the Committee of Works—the consideration of which was, in conformity with a motion of the Board, postponed to that day—be finally adopted:—"To adopt a system of pumps for the purpose of obtaining an increased depth of water in the Great Float and the Board's docks at Birkenhead, at an estimated cost of £45,000." He said that their object was to deepen 130 acres of docks at Birkenhead by a system of pumping similar to that which was in successful operation at the Sandon Dock, and was being carried out at the Coburg Dock on the Liverpool side of the Mersey. One necessary adjunct of a scheme to raise the water in any part of the dock system was that there should be, what he would call for want of a better name, a vestibule dock with deep entrances. Without that, large ships could not enter the docks, and therefore could not avail themselves of the depth of water which the docks contained. Such a vestibule with deep entrances existed very amply in the case of the Alfred Dock system, which had its outer sills laid at a level of 12 ft. below the dock sill. This would be equal to the depth of any entrance on the whole estate, and there was also a lock of considerable length and moderate width which would take in vessels of ordinary size. At the same time, the Alfred Dock itself might be used as a locking-out apparatus for vessels of extremely large size. If the present scheme was approved and carried out, they would have over the East and West Float and the Alfred Dock a depth virtually sufficient for any vessel, and thus the whole of that portion of the estate would be available for any vessel that might come into the port of Liverpool. Mr. Brancker seconded the motion, which was agreed to. [The system was fully explained and commented upon in our Editorial Notes, August issue.]

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from August 27th to September 24th, 1888:—

Allden, F. A., assistant engineer to the *Rover*, to date September 4th.
Allsop, C., engineer to the *Asia*, additional, to date August 31st.
Basson, Henry, acting assistant engineer to the *Penelope*, to date September 6th.
Bennington, J. W., chief engineer to the *Egeria*, to date September 11th.
Bingham, Percy, assistant engineer to the *Cleopatra*, to date August 27th.
Booth, John W., assistant engineer to the *Champion*, to date September 5th.
Burnes, Thomas, staff engineer to the *Excellent*, to date September 29th.
Coad, H. J., assistant engineer to the *Magicienne*, to date August 27th.
Craddock, G. T., staff engineer to the *Minotaur*, to date September 5th.
Cummings, R. T., engineer to the *Pelican*, to date September 10th.
Davies, W. R., assistant engineer to the *Northumberland*.
Denison, Edward L. H., engineer to the *Pembroke*, additional, to date September 17th.
Eckford, Peter, fleet engineer to the *Northumberland*, to date September 1st.
Eyre, C. V., assistant engineer to the *Iron Duke*.
Faulkner, P. F., assistant engineer to the *Volage*, to date September 4th.
Fedarb, William, engineer to the *Severn*.
Gedge, H. A., assistant engineer to the *Monarch*.
Gregory, C. W., engineer to the *Handy*, to date August 31st.
Griffin, Daniel, engineer to the *Serapis*, to date September 1st.
Hardcastle, C. V., acting assistant engineer to the *Cleopatra*, to date August 27th.
Hill, C. H., acting assistant engineer to the *Agincourt*, to date August 27th.
Hinks, Frederick H., assistant engineer to the *Agincourt*.
Hughes, Thomas, staff engineer to the *Excellent*, to date September 29th.
Hull, Henry, fleet engineer to the *Hercules*, to date September 1st.
Ireland, J. H. H., assistant engineer to the *Tyne*.
Irwin, Richard, staff engineer to the *Hearty*, to date September 19th.
Kingsnorth, A. F., assistant engineer to the *Daphne*, to date September 6th.
Lancashire, J. E., assistant engineer to the *Monarch*.
Leader, H. J., acting assistant engineer to the *Rupert*, to date August 31st.
Lecky, C. B., assistant engineer to the *Canada*, to date September 7th.
M'Ewan, George, chief engineer to the *Excellent*, additional, to date September 29th.
M'Gregor, William, assistant engineer to the *Iron Duke*.
Mitchell, W. H., chief engineer to the *Sharpshooter*, to date August 31st.
Mogg, William G., acting engineer to the *Indus*, additional, to date September 1st.
Newton, G. S., staff engineer to the *Excellent*, additional, to date September 1st.
Newton, George S., staff engineer to the *Indus*, additional, to date September 17th.
O'Neill, John, assistant engineer to the *Agincourt*.
Rutter, E. J., assistant engineer to the *Tyne*, to date September 7th.
Ryder, John F., chief engineer to the *Thalia*, to date August 22nd.
Sanders, John S., chief engineer to the *Spanker*, to date September 1st.
Skinner, W. H., chief engineer to the *Tyne*, to date September 7th.
Stanmore, H. C., staff engineer to the *Melpomene*, to date August 31st.
Taylor, George R., engineer to the *Active*, to date September 4th.
Toop, Henry, acting assistant engineer to the *Iron Duke*, to date September 5th.
Tregenna, H. E., assistant engineer to the *Northumberland*.
Vaughan, John A., acting assistant engineer to the *Champion*, to date September 5th.
Vogwell, C. A., fleet engineer, appointed to H.M.S. *Calypso*, to date October 15th.
Wall, Lewis, acting assistant engineer to the *Northumberland*, to date September 6th.
Ward, J. F. H., assistant engineer to the *Severn*.
Willey, Edward H., fleet engineer to the *Severn*.
Wisnom, W. M'K., assistant engineer to the *Nymphe*, to date September 5th.
Wootton, W. W., chief engineer to the *Salamander*, to date August 31st.

THE AUSTRO-HUNGARIAN LLOYD.—The aggregate distance run in the first half of this year by the steamers of the Austro-Hungarian Lloyd was 3,921,480 miles, showing an increase of 60,273 miles, as compared with the corresponding distance run in the corresponding period of 1887. The revenue collected by the company in the first half of this year was £359,412, or £4,862 more than the corresponding collection in the corresponding period of 1887.

HOAR & BROWN'S HARDWOOD MARKET REPORT, 24th September, 1888.

Teak.—The deliveries for the four weeks ending the 21st September were 1,219 loads, and the total deliveries for the eight months of this year were 11,358 loads, against 7,114 loads in 1887 and 7,635 loads in 1886.

The stock consists of 8,175 loads against 11,428 loads in 1887.

The better feeling reported in our last continues, and higher prices are being obtained.

Shipbuilding yards are all very busy, and large contracts for ships, we understand, are about to be given out.

The wagon-builders are also fairly well supplied with work.

We are further informed that large sales forward have been made at improved prices.

ANGIER BROTHERS' STEAM FREIGHT REPORT.

September 22nd, 1888.

Freights during the past fortnight have continued very firm, with a further rise in some trades, but a slight relapse in a few cases from the highest points touched, consequent on the momentary requirements being satisfied; but the general course of the market gives unmistakable proof of the solid basis on which the present satisfactory level of rates rests. The China trade continues to present a contrast to the general condition, the demand for room being still too limited to effect a rise in rates equal to the nearer home trades; but from Japan and Siam the last paid for rice cargoes shows a substantial advance; the same applies to Java. The Australian homeward market continues disorganised through the strikes. India rates are firm at a good rise from Chittagong, Calcutta, Bombay, and Karachi. Azoff, Black Sea, and Danube business has been extensive at very full rates, but this week closes with a slight drop of about 1½d. to 3d. per quarter on the best figures paid, though there are no signs of any permanent weakness. Mediterranean rates have advanced beyond the proportionate figures of Black Sea, and some exceptionally good prices were paid from Smyrna, Alexandria, and the ore and fruit ports. Baltic freights have given way a little. American business from the United States shows considerable firmness for grain, cotton, and provisions, and promises very good employment all the winter. Brazils and River Plate work is good outwards, but homewards thence little is offering at the moment. Outward rates are still poor to the Mediterranean ports, but well maintained to the East and South America. Time charters are more offered at full pay for three to twelve months.

Engine and shipbuilders have raised their prices, and few can now give delivery before next summer. New and second-hand steamers are well bid for at very full prices.

INDUSTRIAL NOTES.

CLYDE AND EAST OF SCOTLAND.

SHIPBUILDING, steel-making, and indeed all our leading local industries have continued throughout the bygone month in the same healthy activity by which they were characterised during July. Not only are the shipyards on both the lower and higher reaches of the river fully employed, but there is some talk of re-opening one or two of the yards which have been for some years in disuse. Respecting details of the work overtaken, we find that close on 30,000 tons of new work was put into the water during July, whilst during the first half of August, *i.e.*, from the 1st to the 15th inclusive, as many as eleven vessels, having an aggregate tonnage of nearly 18,000 tons, were launched from Clyde yards. In the same period fresh orders representing a total tonnage of some 29,000 tons were booked. In this calculation we do not include the "rumoured orders" which have seen the light through the medium of the local prints, the accuracy of which has not been satisfactorily verified. Perhaps the busiest firm on the whole river is the Messrs. Russell & Co., of Greenock and Port Glasgow. This firm has three yards with accommodation for the building of 14 vessels, and all the berths are stated to be fully occupied, while they have enough work to keep them going till the middle of next summer. It is worthy of note that a large proportion of the new work contracted for consists of sailing-ships, some of which are of great dimensions.

As indicated above, local engineers—marine and general—are participating in the present trade revival, and several important contracts for ships' machinery, &c., have been secured by West of Scotland firms.

Operations at the principal iron and steel manufacturing works in the district also continue unusually active, "night-shifts" having in some instances been resorted to.

It is interesting to note that the steel screw steamer *Ormea*, recently launched by the Ardrossan Shipbuilding Co., is the first steel vessel ever built at that port. The Company are now in a position to build large vessels in either wood or iron, their yard having lately been re-arranged and fitted with plant for this purpose.

It is currently stated that the iron shipbuilding yard situated at Alloa, and which has for some years been closed, has been leased by the Grangemouth Dockyard Company.

A number of ships' sales again fall to be recorded. Amongst these we might specify the *Pelham* (610 tons gross) and the *Falcon*—both steamers—which have been purchased by Mr. David MacBrayne from the City of Cork Steamship Co., and the s.s. *Macmillan*, which has been bought by Messrs. Macbeth & Gray, Glasgow, from Messrs. A. Macmillan & Son, Dumbarton. The price paid for the last named is stated to have been £11,000.

The past month, like its predecessor, has been fruitful of quite a batch of disputes between employer and employed. As might have been imagined, the shipbuilding trade figures prominently in this connection, though it must be conceded that a sort of come-and-go spirit has, generally speaking, prevailed on the present occasion between the respective disputants. This is clearly proved when we state that the masters have in some cases raised the wages of their employés without being approached on the subject. Nevertheless the men, all round, are not satisfied. The leaders of the various trade unions are meanwhile "holding their breath," and only await the natural development of matters ere proclaiming a general strike throughout the Clyde yards, with the object of obtaining a substantial advance on the current rates of payment.

Some attention has been drawn to the barque *Europa*, hailing from Norway, which put into Greenock lately. The vessel has the distinction of being "a very old ship," having been constructed so far back as 1801.

Mr. James Thomson, C.E., of Messrs. Denny Brothers' yard, Dumbarton, has been appointed lecturer on naval architecture to the West of Scotland Technical College, in room of Mr. George Brown, resigned.

Mrs. Elder, widow of the late John Elder, the distinguished marine engineer, has just decided to give annually a bursary of £30, tenable for two years, to the most deserving student of naval architecture attending the classes of the Govan Young Men's Christian Association. These classes, it may be stated, are mainly recruited from among the working people of the district.

Greenock promises to become a much more important commercial centre than it has yet attained to. Judging from the movements afloat thereabout just now, I should say that a large building, to serve the triple purpose of a corn exchange, stock exchange, and sugar exchange, will be erected at no far distant date.

Though rather early in the year to begin making comparisons between the output for 1887 and that of 1888, it is nevertheless interesting at this stage to note that the total amount of work built on the Clyde between the 1st January last and the 22nd September was over 171,000 tons, or within some 14,000 tons of the entire output for last year.

An official trial of Messrs. Gray & Hughes' combined lifeboat and deck-seat took place in the river Kelvin (inside the Exhibition grounds), on the 12th September, with satisfactory results. This boat is constructed of galvanised iron and steel, is divided into 28 air-tight compartments, and is capable of holding 30 persons.

A new creozoting factory is about to be erected at Irvine, in Ayrshire, by the Glasgow and South Western Railway Company.

North of Scotland.—While trade generally has been brisk in this district throughout the month, workers' strikes have been unpleasantly numerous. The dispute between the Aberdeen shipyard workers and their employers has happily terminated, the demands of the men for an advance of 2s. a week on the fixed wage and 7½ per cent. on piece work having been conceded by their employers. The employées of Chapel Works, Montrose (Messrs. J. & G. Paton), to the number of 1,000, struck work on the 31st August for an advance of wages, but resumed work a few days afterwards on the understanding that their claims would be

favourably considered by the manager. The rates paid in this work are stated to be exceptionally low, the men (strikers) receiving 14s. 9d. a week, and some of the women as low as 5s. a week.

The Industrial Exhibition at Aberdeen closed on Saturday, the 22nd September. The exhibition was visited by upwards of 60,000 persons during the three months it was open.

Several fresh orders for vessels have within the past week or two been obtained by north-country shipbuilders. The most notable of these is a contract for the construction of a cargo-going steamer which has been placed with Messrs. W. B. Thompson & Co., Dundee, by the Clyde Shipping Company. This vessel is to have a deadweight carrying capacity of 5,300 tons, and will, I believe, be the largest steamship yet built at that port.

TRADE NOTES FROM THE TYNE, WEAR, TEES, &c.

The Tyne.—Shipbuilding on the Tyne is now almost as brisk as it was in the inflated period between 1880 and 1884. There are scarcely any idle berths (always excepting, of course, the one or two yards that are inoperative), and but one unsold steamer on the stocks. The establishment which has the distinction of retaining on the stocks the only vessel laid down and built during the inflated time referred to, is Messrs. Schlesinger & Davis's, and it is scarcely to be expected that, in presence of the greatly stimulated demand for steamers which has lately arisen, this fine vessel will remain long on hand. The berth occupied by the steamer just referred to, is the only one at this establishment that can be said to be idle, for the remaining five are taken up with vessels varying from those of the river-steamer type to the modern cargo boat of large carrying capacity. Messrs. Swan & Hunter's yard, which adjoins the establishment just spoken of, is still occupying a foremost place in point of briskness, and some of the vessels for which the firm now have orders are of a very superior type. Messrs. Hawthorn, Leslie & Co., having lately been commissioned to build two steel sloops for the Admiralty, are finding it expedient to effect certain changes in the arrangement of their premises, with a view to permit of the Government work being carried on separately from the ordinary work of the establishment. This firm have lately booked orders from foreign owners for steamers of superior type and large tonnage. Messrs. Palmer & Co. continue to keep their dozen berths or more pretty constantly occupied, for as soon as a vessel is put off the stocks another is put down in its place. In the half-yearly report lately issued by this firm, and in which a dividend of 2½ per cent. was declared, it was assigned as a reason for diminished profits that the workmen had prematurely insisted on advances of wages, which action had not only caused a serious hindrance to operations, but had also had the unfortunate effect of driving some important contracts into the hands of competing firms in other districts. The Tyne Shipbuilding Company have four large vessels on their stocks, and have just made ready for sea a splendid steamer named the *Ambassador*, which has been built to the order of a leading Newcastle firm. Messrs. Edwards' yard, Howdon, is now closed, but it is understood that it will soon be re-started by a new company, in which a local gentleman who, besides being a practical shipbuilder, is quite at home in the theoretical principles of the art, is to be managing director. Low Walker is at this moment an exceedingly busy centre. Messrs. W. Dobson & Co. have three large steamers in progress, and Messrs. W. Richardson & Co. have five on the stocks and two in the water undergoing the finishing touches. Messrs. Armstrong, Mitchell & Co.'s yard, which, though coming last in this connection, is by far the largest and most important establishment at this point of the Tyne, is quite full of work, and preparations are now being made for proceeding with the construction of two vessels (when berths are open for them) which are expected to exceed in largeness of dimensions any that have yet been turned out from this establishment. Messrs. Wood & Skinner, of the Bill Quay yard, have just laid the keels for two large vessels, and have a third berth occupied with a vessel in the plating stage. Messrs. T. & W. Smith, of North Shields, have a small vessel on the stocks, and have others to proceed with. Messrs. Readhead, of Tyne Dock, are plentifully supplied with orders, and for a long time past have been in a position to utilise at least four out of their five building-berths. At the different marine engineering shops a high-pressure state of activity continues to be apparent, and there is no instance in which night-work is not to a greater or less extent carried on. Messrs. Ernest Scott & Co., of the Close Works, Newcastle, who long since achieved a high reputation as manufacturers of engines of a special class, such as are used in steam launches, pleasure yachts, torpedo boats, &c., have recently commenced to build engines of a larger type, and will no doubt prove themselves capable of equal success in this department of the industry. Messrs. Black, Hawthorn & Co., Gateshead, have engined several vessels this year, and have engines for other vessels now in progress. This firm are doing an exceedingly brisk business in other departments of their works. Messrs. Garrick & Wardale continue to experience a good demand for their engineering specialities, and Messrs. Emerson, Walker, and Thompson Brothers, Limited, have the whole of their extensive factory in full and regular operation. In the steel and iron trades the state of work is much better than at any period for several years, and there is now no idle labour in connection with these industries. Messrs. Spencer's steel works, Newburn, are still showing the fullest animation in every department; and at the Elswick steel works, belonging to Messrs. Armstrong, Mitchell & Co., it is being found necessary to put down additional plant of a ponderous and exceptionally effective type. At the Walker blast furnaces smelting of Swedish ore has been commenced, and it is said that the results are extremely satisfactory. The ironworks which were formerly worked concurrently and in connection with those furnaces, but which for some years have lain wholly inoperative, are being partially dismantled, and rumours respecting the prospective construction of steel works on the site continue to be rife in the district.

The Wear.—The state of shipbuilding on the Wear closely approaches the condition of the same industry on the Tyne, excepting in the fact that on the smaller river there is no Government work in hand. The Wear yards, however, are showing more activity than has existed for years, and the only cause of stoppage which is now heard of at any establishment, is the difficulty of procuring steel material from the manufactories. It is probable, however, that in the course of a few months this difficulty will be greatly lessened, if not entirely done away with, by the commencement of the steel plate and angle manufacture on the site of the Castletown ironworks. A company for taking over the latter, with a view to carrying out the purpose mentioned, has just been registered, and a preliminary list of principal shareholders has been published, which includes the names of some of the leading engineers and shipbuilders in the district. Amongst those may be mentioned Mr. James Laing, Mr. Andrew Leslie, Mr. John Dickinson, Mr. J. Y. Short, and Mr. Robert Thompson. It is needless to say that the identification of these gentlemen with the scheme in question is a pretty reliable guarantee of its success. During the month of September the launches on the Wear were very numerous, the most important being the launch of the s.s. *Patapsco* from Mr. Laing's yard on the 18th. This builder has several exceptionally large vessels to put down, and has now in progress a vessel ordered by the British Steam Navigation Company, in respect of which it may, with perfect truth, be said it is the largest merchant or passenger steamer ever constructed in the North. Messrs. J. L. Thompson and Sons have launched twelve vessels this year, and expect to put six others off the stocks before the year closes, unless a visitation of unusually bad weather should upset their calculations. Messrs. Short Brothers have a great number of orders to deal with, and some of the vessels now on the stocks are of exceptionally large dimensions. Messrs. Priestman & Co., who only resumed operations a few months ago, after a couple of years' stoppage, are now preparing to place a third large vessel on the stocks. Messrs. Osborne & Graham, who also had their yard closed for a long period, and only recently resumed work, are putting down the keels for two vessels, and are busily framing another. Messrs. R. Thompson & Sons are proceeding with the construction of two large vessels at their Southwick yard, and have just had under repair in their graving dock the locally owned steamer *Cleanthes*. The Sunderland Shipbuilding Company are just now mainly concerned with foreign orders, the two last vessels launched by them having been for Germany, and three of those now on the stocks being ordered by owners hailing from the same country. At the yards to which no special reference has been made, business in every case is brisk. The pressure of work at the engineering establishments continues as great as ever, and some firms are finding it necessary to advertise for fitters and turners. The new Fairbairn crane (Davis & Primrose makers) which has been erected at the Scotia Engine Works was tested for the first time on the 20th inst. with a lift of 15 tons. This weight was evidently a long way below the lifting capacity of the crane, and

the greatest confidence was expressed by experienced lookers-on that it could take four times the weight with absolute safety. This confidence was amply justified by subsequent trials, and it may now be said, without the slightest approach to exaggeration, that this establishment is provided with a quayside lifting apparatus which, besides being absolutely reliable as to strength, is at the same time quick in movement and exceptionally handy to work. The Pier Engine Works Company have commenced the manufacture of a new speciality (the invention of Mr. George Robson, of Sunderland), called the "Empire Corrugated Spring Piston Packing." It is claimed for this speciality that it is more easily adapted and placed in position than any other packing extant, and that it is at the same time simple of construction, extremely sensitive in action and very durable. Mr. John Wigham, steam winch manufacturer, &c., Hylton, has wrought a new valve gear, the object of which is to dispense with the link motion in steam winches. It is regarded by competent authorities as a great improvement, and is likely to be largely adopted. The whole of the foundries are full of work, and rivet manufactories are busy. The Monkwearmouth Ironworks still show great briskness in all departments.

The Hartlepools.—Messrs. Withy & Co. have several steamers of a large class now in progress, and throughout the various departments of their establishment extraordinary briskness continues to prevail. At Messrs. W. Gray & Co.'s yards all berths are full, and it is understood that the firm have contracted to build a good many vessels, the construction of which will have to be delayed for some time yet. The firm are noted for rapidity of execution, but in spite of their undoubted right to that reputation, they are now unable to satisfy impatient customers who press for early delivery of vessels. The Central Marine Engine Works have probably not been so busy since their opening as at this moment, and the exceptional facilities for quick production are just now being very fully utilised. Messrs. Richardson's works are also fully employed. At the docks an improved state of business is apparent.

The Tees.—The new shipyard which was laid out at Middlesbro' towards the close of the last busy period, but which was never opened for work, has been leased by Messrs. Raylton Dixon & Co., and will be started as a working concern by that enterprising firm almost immediately. It is a well-arranged establishment, and, being provided with first-class modern machinery, may be looked upon as possessing within itself the primary conditions for successful working. It is stated that a site has been procured for the establishment of another new shipyard at Middlesbro', and the names of the gentlemen who are to be the leading spirits in the movement have been published. The yard at Stockton, which for a term of 35 years was in the possession of Messrs. Pearse & Co., but which some months ago passed into the hands of Messrs. Ropner & Sons, is being altered with a view to facilitate the building of vessels up to 400 feet in length. New machinery of a powerful type is also being put down, and additional frame furnaces are to be built. The other shipbuilding establishments at Stockton are in full activity, and the same may be said of the engineering works, forges, and boiler manufactories. The Teesside Iron and Engine Works Company are about to substitute "regenerative stoves" for two of their blast furnaces which were recently blown out. By this means, it is expected that the cost of producing pig-iron will be much reduced. The steel works are exceedingly busy, and in the iron-works the improvement which commenced some weeks ago is being further developed.

THE MERSEY.

THERE is very little fresh to report from the Mersey, no new orders of sufficient consequence to merit special notice having been placed at any of the yards; whilst the strike amongst the boilermakers and ironworkers generally for a material advance in wages has considerably interfered with the work now in hand. The men have been successful in their efforts, and the employers have been forced to concede an advance of 5 per cent. on piecework and 1s. 6d. per week to those on weekly pay. This will tell very severely on those shipbuilders who are working off old contracts—dated prior to the improvements in freights—and which were, in many cases, taken only to keep the machinery going and the permanent staff together. So far they will be sufferers; but we think the higher price of labour will perhaps be the means of restraining over-jubilant shipowners from repeating the errors committed in 1882-3-4, and deluging the freight market with steamers for which there are no cargoes. It has been strongly recommended by some Solon, whose other name we have forgotten, *never to halloo until you are out of the woods*, but by some owners this sage advice seems to be entirely forgotten. But there are difficulties which, however safely passed, are never to be treated with contempt; and there are woods whose silence it is always wise *not* to disturb, as there are frequently hidden elements of danger, unknown or at any rate forgotten by the traveller, which are aroused by the triumphant song discoursed when the journey is thought safely over.

There are already building a larger fleet of steamers than necessity would seem to demand, and in February next a considerable addition will be made to the steam tonnage of the country.

Messrs. William Johnston & Company, we are informed, have three large steamers on the stocks, but only one in Liverpool, Messrs. Royden & Sons having secured this boat, the other two steamers being built in Belfast.

Messrs. W. & R. Thomson are building a large cargo steamer for their "Bedouin" line, with Messrs. Armstrong, Mitchell & Co. This makes the eleventh steamer that Messrs. Charles Mitchell & Company and the new firm, consisting of a combination of Messrs. Sir William Armstrong & Co. and Messrs. Charles Mitchell & Company, have built for the same owners. It seems a pity that so much Liverpool business should go elsewhere, but we presume the reasons for this must be weighty, as naturally a shipowner would prefer to have his vessel constructed near enough to his headquarters to permit of a personal as well as a professional supervision.

Referring again to the vessels now being built by Messrs. W. Johnston & Co., we have just heard that this well-known firm are about to contract for another steamer. We have every reason to believe that the contract is still an open question, so possibly this may be information that may prove valuable to some of our readers.

Freight markets continue exceedingly good, and in nearly every direction rates have steadily and constantly improved until the last week, when the good weather operating unfavourably upon the wheat market has in some cases occasioned a relapse of a nature more or less slight; but the upward movement, at any rate, is *for the moment* checked. Of course, rates cannot possibly go steadily upwards without a reaction, but we quite believe that there is substantial improvement in freights yet due if the pernicious habit of fixing ahead be only abandoned. We will have something more to say on this subject later on; but to indicate the soundness of the present "boom," we find that freights both *outwards* and *homewards* are on a remunerative basis. Hitherto, if one has improved somewhat, the other freight has decreased correspondingly or more. Now, *nous avons changé tout cela*. Even India has at last participated in the rise, and 23s. 6d. to Bombay and 28s. 9d. home indicate a healthier state in that market than has been current for many years. Calcutta rates homeward are exceedingly stiff; 47s. 6d., and even 50s., has been paid for jute, whilst all the rice ports from Japan to Rangoon are offering more money both for prompt and backward tonnage.

Grain freights, perhaps, have most notably indicated the improved tone of the market, both from Russia and from America. New Orleans rate is now 6s. per quarter; from Baltimore 5s. 3d. has been done, and from New York 5s. is offering. These are all remunerative rates, though they hardly yet compare with the Black Sea grain freights. Odessa *has* paid 32s. 6d. direct for a boat of 10,000 quarters. This is perhaps the absolute top of the market; but even now 28s. 9d. to 30s. can be obtained for a moderate-sized boat. Of course, Nicolaieff always pays 1s. 3d. to 1s. 6d. per ton higher than Odessa or Sevastopol. All Russian rates for grain are per ton tallow, which is about 27½ cwt. English.

Cotton freights have been exceedingly good, but we fear the action of the spinners in this country, *i.e.*, limiting the work to three days per week, may have a deleterious effect upon rates. So far the figures are abnormally high. From Galveston 65s. on the nett register has been paid, free of all stevedoring and compressing, whilst New Orleans, although unfavourably situated through the near proximity of the yellow fever, is only 2s. 6d. per nett register ton short. The northern ports are all paying good rates for October loading, as the crop this year is rather late. Savannah is offering 27/64ths to United Kingdom and Continent. This ought to leave a handsome profit; whilst

Charleston, Wilmington, &c., are paying rates corresponding to the difference in the cost of ports.

With reference to our remarks as to the advisability of not fixing ahead, we would say that we know of one firm who are carrying grain from Odessa at 21s. 3d. and 22s. 6d., whilst their neighbours' boats loading alongside are receiving from 7s. 6d. to 10s. per ton more money. We are also cognisant of one firm—and a very good one, too—who have several boats fixed ahead from Galveston at 44s. and 45s., whilst the present rate is 20s. per ton higher. We can only hope that the lesson will not be lost, and if it only be a means of teaching shipowners to wait for their markets, and not to attempt to push for the present without due regard to the future, the lesson, although a dear one, will be worth the cost.

BARROW-IN-FURNESS.

THE hematite pig-iron trade maintains a very steady and firm tone, and the business done has been on a large scale, and at the fuller rates which have been ruling. Mixed numbers of Bessemer iron are quoted at 46s. per ton, and business has been done generally at about this figure, although warrants have been slightly higher. No. 3 forge and foundry iron is firm at 45s. 6d. net f.o.b. Stocks are smaller than they have been in the hands of makers, but hematite warrants show a slight increase. In the steel trade a much firmer tone is noted, and an increased business is doing at fuller prices all round. There is a brisk demand for rails, both of heavy and light sections, the former having advanced to £4 2s. 6d. net f.o.b., and the latter ranging from £4 5s. to £4 12s. 6d. The mills are very busy, makers are largely sold forward, and the demand is alike on home, foreign, and general colonial account. A considerable impetus has been given to the trade in steel shipbuilding material, plates having advanced to £7 5s. per ton and angles to £6 12s. 6d. Billets, tin bars, and hoops are still a brisk trade, and advances in prices are noticed for all these articles. New orders are at length reported in the local shipbuilding trade, and others are likely to be placed during the ensuing month. Engineers, both marine and general, are busier and have a better outlook, and a corresponding improvement is noticeable in the boiler-making and iron-founding trades. Iron ore still feels the benefit of the increased freights on Spanish ore, and ordinary qualities are steady at from 9s. to 12s. per ton at mines.

SWANSEA.

THE trade of the port has been of a most gratifying character, and the statistics leave no ground for doubting that Swansea is obtaining a full share of the general improvement in trade which has set in. The total imports and exports have been 11,000 tons above those of the previous week, and 7,000 tons in excess of that of the corresponding week of last year. The imports amount to 14,296 tons, and the exports to 47,213 tons; total trade 61,509 tons, compared with 50,690 tons in the previous week, and 54,876 tons in the corresponding week of last year. The shipments of tin-plates in the week were 46,197 boxes, and the receipts from works 29,254 boxes. The stocks in the dock, warehouse, and vans this day amount to 54,961 boxes, as compared with 61,904 boxes this day week, and 81,388 boxes at the corresponding date of last year. The demand for tin-plates continues exceptionally good, but the fluctuating form of tin is having a disturbing effect on forward transactions. Makers, in view of the strong American inquiry, and to meet the increased cost of iron and tin, have further raised their quotations. All works are full for some time ahead.—*September 22nd.*

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—ENGLISH.

Rohdal.—On August 23rd the launch of a steamer—the largest ever built in the port of Falmouth—took place at the shipbuilding yard of Mr. W. H. Lean, J.P., Falmouth. In consequence of the long run which she had, and there not being sufficient water, she grounded about half-way down the stocks; but the combined efforts of the steamers *Pendennis*, *Briton*, and *Kimberley*, and the winch on board the *Rohdal* proved successful and she was towed into harbour. As she glided off the stocks she was christened the *Rohdal* by Miss Annie Lean. Her dimensions are 150 ft. by 24 ft. by 11 ft. 10 in., and she will carry, including bunkers, about 550 tons on 11 ft. draught. She has been purchased by Holdt & Isachsen, of Stavanger, Norway, for service in the Mediterranean trade, and she will be commanded by Captain Sievertsen.

Nether Holm.—On August 25th Messrs. Hine Brothers added to their fleet a steel steamer, which was launched from the shipbuilding-yard of Messrs. Joseph L. Thompson & Sons, North Sands, Sunderland This vessel has been built under the supervision of the firm's steamship superintendent, Captain George Brown, and under special survey for the 100 A1 classification, being of the raised quarterdeck type, having short full poop and long bridge extending to fore side of foremast and full topgallant forecastle, thus leaving a very short well forward. She is built on the web-frame and longitudinal plate intercostal system, dispensing with 'tween-deck and hold beams, thus facilitating the loading and discharging of steel rail or timber cargoes. The whole of these stringers have been riveted by hydraulic machinery. The frames for two-thirds of the vessel's length are of the Z section, and the plating of the upper structure considerably increased in thickness. The holds are divided by five steel watertight bulkheads. The vessel has iron decks fore and aft, ample water ballast, and is additionally strengthened under the engine and boiler space. The dimensions are such as to adapt the vessel to trade to ports which are inaccessible to vessels of deep draught of the same deadweight capacity. The deck machinery consists of direct steam windlass, four powerful horizontal steam winches, and steam steering gear, and every modern improvement has been adopted in order to render the vessel as complete as possible. The machinery is of the latest type. The triple-expansion engines have three cranks, with cylinders 21, 35, and 57 respectively, and a stroke of 39 in., and are being fitted by Mr. G. Clark, of Southwick. There are two boilers, which are of steel, and of the multitubular form, having a working pressure of 160 lb. to the square inch. A special feature in this department are the three crank shafts. These are usually of iron, but in this vessel they are of steel forgings, from the works of Messrs. Chas. Cammell and Co., of Sheffield. The ceremony of naming the vessel *Nether Holm* was performed by Mademoiselle Cecil Gaudin, of Lausanne.

Eleanor.—On August 25th a steel screw schooner-rigged vessel was launched from the yard of Messrs. H. S. Edwards and Sons, at Howdon. Her dimensions are as follows:—Length, 270 ft.; breadth, 36 ft. 6 in.; depth moulded, 22 ft. 3 in. She has been constructed on the cellular system throughout, with a long bridge, leaving a well on the fore deck. The crew are to be berthed under the fore end of the bridge, and a full poop with accommodation for officers and a few passengers will be constructed. The vessel was named the *Eleanor*. She has been built for Mr. Alexander, of Newcastle, who has personally superintended her construction. She is intended for the general cargo carrying trade, but has been specially contrived for the carrying of grain. She will have a cargo carrying capacity of 2,850 tons. Her engines have been built by Messrs. Rennoldson & Co., South Shields.

Apex.—On August 25th there was launched from the Howdon Yard of the Palmer Shipbuilding and Iron Company (Limited), a steel screw steamer of the following dimensions:—Length between perpendiculars, 275 ft.; moulded breadth, 37 ft. 6 in.; and depth, 20 ft. 1 in. The vessel is schooner rigged, and has a long raised quarter about 108 ft. in length. The captain and officers will be berthed in the poop deck aft, while accommodation for the engineers will be provided at the after end of the bridge house, and for the crew forward in the main deck. The vessel will have five water-tight bulkheads, and will be fitted with water ballast on the cellular-bottom principle, with steam steering gear, winches, screw gear aft, direct steam windlass, and all the latest improvements. The engines will also be built by the Palmer Company. The vessel has been built to the order of Messrs. Newman & Dale, of Newcastle, and was named the *Apex*.

Hydra.—On August 29th there was launched from Messrs. W. H. Potter & Sons' shipbuilding works, Queen's Dock, Liverpool, an iron screw steamer of the following dimensions:—Length, 240 ft.; beam, 34 ft.; depth, 16 ft.; tonnage, B.M., 1,350 tons. The vessel was named the *Hydra* by Miss Potter. The *Hydra* has been built to the order of Mr. Alfred Holt, of Liverpool, for the Oceanic Steamship Company, and is similar to

the screw steamers *Hecate* and *Medusa*, previously built for Mr. Holt by Messrs. Potter. The *Hydra* will be fitted with triple-expansion engines of the most approved type, which are being constructed by Messrs. D. Rollo & Sons.

Knutsford.—On September 1st a steel screw steamer, named the *Knutsford*, built for Messrs. Carlisle & Co., London, was launched from the shipbuilding yard of Messrs. C. S. Swan and Hunter, Wallsend. The vessel is of the following dimensions:—Length, 290 ft.; breadth, 37 ft. 6 in.; depth moulded, 21 ft. 3 in.; and classed 100 A1 at Lloyd's. She has been built under special survey, and has full poop, long raised quarterdeck, long bridge house, topgallant forecastle, water ballast in cellular double-bottom, all fore and aft, steam winches for the rapid discharge of cargo, large donkey boiler, steam steering gear, direct steam windlass, and other appliances of the most modern design. The triple-expansion engines and boilers have been built by the Wallsend Slipway and Engineering Company, and are capable of indicating 1,100 H.P., and of propelling the vessel 10 knots. The ceremony of naming was performed by Mrs. James Huddart, of Melbourne, Victoria.

Linotte. — On September 4th there was launched from the Vectis Works and Shipyard of Messrs. William White & Sons, at West Cowes, a composite steam yacht, built to the order of Monsieur E. Perignon, to class 20 years A1 at Lloyd's. She is rigged as a two-masted schooner, with masts that can be laid down on deck in case of need, so as to enable her to navigate the French rivers. Her principal dimensions are:—Length between perpendiculars, 94 ft.; length on waterline, 88 ft. 6 in.; beam, 14 ft. 6 in.; depth, 8 ft. She is fitted with a pair of compound surface-condensing engines, with cylinders 12 in. by 24 in. and 18 in. stroke. The engines as well as the steel boilers are both by the above firm, and are made up to Lloyd's requirements. On leaving the ways the vessel was named the *Linotte*.

Cyrene.—On September 4th Messrs. Short Brothers launched from their yard at Pallion, Sunderland, a steel spar-deck screw steamer, built to the order of Messrs. Lumsdon, Byers & Co., of Sunderland, of the following dimensions:—Length, 302 ft.; breadth, 42 ft.; and depth of hold, 27 ft. 5 in.; with a deadweight carrying capacity of about 4,100 tons. She is constructed to the highest class in steel to Lloyd's Registry, with water ballast in after and fore holds, the holds being sub-divided by six watertight bulkheads, with extra large hatchway to each hold, five steam winches, and large multitubular donkey boiler on deck, Emerson, Walker & Co.'s steam windlass, steam steering gear, and all the latest improvements. The officers' and engineers' accommodation is amidships, the seamen and firemen being berthed in a topgallant forecastle. On leaving the ways the vessel was named *Cyrene* by Mrs. W. L. Byers. The vessel was towed to the works of Mr. George Clark, Southwick, by whom she is to be fitted with triple-expansion engines of 240 H.P., with steel boilers, having a working pressure of 150 lbs.

Arctic.—On September 4th there was launched from the yard of Earle's Shipbuilding and Engineering Company, Limited, at Hull, the s.s. *Arctic*, which is the first of two steam fishing vessels being built by them to the order of Messrs. Moodys and Kelly, of Grimsby, and which are adapted either for line or trawl fishing. This has necessitated some departure from the ordinary design of steam trawling vessels, the principal feature being a "fish-well" or space amidships, open to the sea by means of perforations through the shell of the ship; a continuous circulation of sea water thus takes place, and enables the fish to be kept alive after being caught. The dimensions are 100 ft. by 20 ft. by 11 ft. 6 in., and the ship is built to Lloyd's highest class, with considerable excesses of scantling over rule. Provision is made in the holds, in addition to the fish-well, for the storage of fish, ice, etc., and the vessel is fitted with a powerful steam winch of Earle's special make, and other appliances are fitted on deck for working two sets of trawl gear. The captain, mate, and engineer are berthed in the cabin under the quarterdeck, and the crew in the forecastle. The ship will be ketch rigged, and will have good sail power. Her engines are on the triple-compound three-crank principle, and have cylinders 12 in., 18 in., and 30 in. diameter, with a stroke of 18 in., these being supplied with steam from a large steel boiler made to work at 150 lbs. pressure.

Unionist.—On September 6th there was launched from the yard of the Strand Slipway Company, Sunderland, a steel screw steamer named the *Unionist*, built for the Angier Steam Shipping Company (Limited), superintended by Captain Cassop. Her length is 265 ft.; breadth, 37 ft. 6 in.; depth, 23 ft. 9 in. After the launch the vessel was towed to the South Dock, where she will be fitted with triple-expansion engines and boilers by the North-Eastern Marine Engineering Company (Limited).

South Briton.—On September 6th there was launched from the shipbuilding yard of Messrs. Schlesinger, Davis & Co. a handsomely-modelled iron screw steamer, built to the order of Messrs. Gibbs & Lee, Cardiff. The principal dimensions of the vessel are as follows:—Length between perpendiculars, 260 ft.; breadth moulded, 37 ft.; depth moulded, 18 ft. 11 in. She is built with a long raised quarterdeck, bridge, and topgallant forecastle, and is rigged as a two-masted schooner. She is fitted right fore and aft for water ballast on the cellular bottom principle. She is also provided with an after-peak tank for water ballast. All the most modern improvements have been introduced for the rapid loading and discharging of cargo, including four powerful steam winches by Messrs. Clarke, Chapman, Parsons & Co.; steam steering gear by Messrs. Davis & Co., London; patent windlass, by Messrs. Emerson, Walker & Thompson Bros. Accommodation for the captain is provided under the raised quarterdeck aft, the officers' and engineers' berths being fitted under the bridge-deck at the after end. The crew are berthed under the topgallant forecastle. The vessel will be fitted with triple-expansion engines with cylinders 19 in., 33 in., and 53 in. diameter by 36 in. stroke, by Messrs. E. Scott & Co., Close Works, Newcastle. The boilers, which are of steel, and will work at a pressure of 160 lbs. per square inch, are being supplied by Mr. J. T. Eltringham, South Shields. The ship on leaving the ways was named the *South Briton* in a very pleasing and graceful manner by Miss Ethel Cave, the little daughter of Captain Cave, who will command the ship.

Era.—On September 6th Messrs. Edward Withy & Co. launched from their shipbuilding works at Hartlepool a large steel screw steamer, built to the order of Messrs. Kinghorn Bros., of Liverpool and Glasgow, for Messrs. W. Howard Smith & Sons, Limited, of Melbourne, Sydney and Brisbane. This is the second vessel of a similar type the builders have constructed for this firm within the last twelve months, the s.s. *Age*, which left in February, being the first, and has proved herself a very economical and satisfactory vessel in every way. This is a handsome type of a modern cargo boat, measuring over 300 ft. in length, and built throughout of Siemens Martin steel, with a large measurement and deadweight capacity, and built to the highest class at Lloyds'. She has a long raised quarterdeck, short poop, long bridgehouse, and topgallant forecastle. The holds are fitted with iron grain divisions and cargo battens, all decks, deck erections, skylights, bulwarks, bulkheads, etc., are constructed of steel. In the main and after holds the vessel is built on the web-frame system, which gives a very strong type of ship, and dispenses with all hold beams, thereby enabling the vessel to carry cargoes of the bulkiest description. Her cellular bottom is fitted all fore and aft for water ballast (Withy & Sivewright's patent), the after-peak is also available for water ballast. The greater portion of the plates are in 24 ft. lengths, making the structure of the ship very strong. Four steam winches, two donkey boilers, steam steering gear amidships, screw gear aft, direct steam windlass on forecastle, patent stockless anchors hauling up into hawse pipes, and all other modern appliances are fitted for the handy working of the vessel. The saloon and cabin providing accommodation for passengers, captain and officers, is handsomely finished in polished hardwood, with neatly painted panels executed in a very effective style by the decorative staff of ladies employed by the firm. The vessel will be rigged as a two-masted fore-and-aft schooner with steel pole-masts, derricks, and all other cargo appliances for expeditious hauling of cargo. The machinery has been constructed by the Central Marine Engineering Co., and is of the most modern type, having three cylinders, two large single-ended boilers constructed for a working pressure of 150 lbs. per square inch, which are expected to propel the vessel, notwithstanding her enormous carrying capacity, at a high rate of speed. The hull and machinery have been constructed under the personal supervision of J. G. Kinghorn, M.I.N.A., of Liverpool. On leaving the ways the vessel was gracefully christened *Era* by Mrs. J. G. Kinghorn. Under the able command of Captain Bannantyne, who navigated the s.s. *Age* and numerous other vessels to the colonies and other foreign parts, there is no doubt that the new steamer *Era* will give as good a record as did her sister ship the s.s. *Age*.

Longstone.—On September 7th there was successfully launched from the yard of her builders, Messrs. Raylton Dixon and Co., a steel screw steamer built to the order of Messrs. Farrar, Groves & Co., of London. The vessel, which is built on the well-deck type, is of the following dimensions:—length, over all,

304 ft. 3 in.; breadth, 38 ft. 2 in.; depth, moulded, 22 ft. 10 in.; with a carrying capacity of 3,600 tons deadweight. She has a long bridge extending to foremast, water ballast on cellular system, and is fitted throughout as a first-class cargo boat. The vessel will be fitted with engines by Messrs. T. Richardson and Sons, of Hartlepool, of 200 N.H.P., with cylinders 22 in., 35 in., 59 in., by 39 in. stroke. She is fitted with patent direct acting windlass by Emerson Walker & Co., London. On leaving the ways she was christened *Longstone* by Miss Fletcher, of Haulgh, Bolton. It is a curious coincidence, not in any way arranged beforehand, that the launch of the vessel of this name has occurred on the very day of the fifteenth anniversary of the daring exploit of Grace Darling from the Longstone lighthouse, after which the vessel is named.

Giang Ann.—On September 8th Messrs. Wigham Richardson and Co. launched from their yard a steamer which they have built to the order of Mr. Francis F. Reid, of Leith, acting for Messrs. Paterson & Simons, of London. The vessel, which is named the *Giang Ann*, is intended for the Singapore trade, and is 240 ft. long, 31 ft. beam, and 23 ft. deep moulded, with engines to indicate up to 900 H.P. She is fitted throughout for European and Chinese passengers.

Glanystwyth.—On September 8th this ship, built by Messrs. Palmer's Shipbuilding Co., to the order of the Glanystwyth S.S. Co., was launched. She has been superintended during construction by Messrs. Flannery, Baggallay & Johnson, of London and Liverpool, and is 255 ft. long, 36 ft. 9 in. beam, and 21 ft. deep; being fitted with topgallant forecastle, long bridge, and poop. She will be steered by Davis & Co.'s combined hand and steam gear, and is fitted with the modern improvements for quick dispatch. Her machinery will be of the triple-expansion type, with cylinders 20 in., 33 in., and 54 in. diameter, and 36 in. stroke, the boilers being of large size, and carrying 150 lbs. steam. She was named, on leaving the stocks, by Mrs. Davies.

Egglestone Abbey.—On September 8th Messrs. W. Gray and Co. launched a fine steel screw steamer of the following dimensions:—Length over all, 300 ft.; beam, 38 ft.; depth moulded, 22 ft. 2 in.; built to the order of Messrs. Pyman, Watson and Co., Cardiff. The vessel will class 100 A1 at Lloyd's and have large internal and deadweight capacity. She is of the favourite well-decked type, with poop aft containing saloon and cabins for officers and a few passengers, long raised quarterdeck, long bridge of extra strength right up to fore hatch, and containing comfortable quarters for the crew; the usual topgallant forecastle is fitted forward with Emerson, Walker & Co's capstan windlass. The hull is built on the web-frame principle, dispensing with hold beams and giving a clear hold for stowing cargo of the bulkiest description. Five hatchways are fitted, four steam winches, steam steering gear and large patent donkey boiler, double-bottom under each hold for water ballast. The boats are carried on beams overhead, and the vessel will in every respect be well equipped for general trading. First-class engines on the three-cylinder triple-expansion principle are being supplied by the Central Marine Engineering Co., West Hartlepool. Working on three cranks they will develop over 1,000 H.P. The cylinders are 22 in., 35 in., and 59 in. diam., and the piston stroke 39 in., and a constant supply of steam at a working pressure of 150 lbs. per square inch will be maintained by five large steel boilers. The vessel has been superintended during construction by Mr. Wm. Birchby, on behalf of the owners. She was gracefully christened *Egglestone Abbey* by Miss Nellie Pyman, daughter of George Pyman, jun., Esq., of West Hartlepool.

Carrie.—On September 8th Messrs. W. Gray & Co. launched a fine steel screw steamer of the following dimensions:—Length over all, 270 ft.; breadth, 36 ft. 6 in.; depth, 19 ft. 5 in.; built to the order of Messrs. C. Nielsen & Co., West Hartlepool. The vessel has large carrying capacity and takes Lloyd's highest class. She is of the well-decked type with a long raised quarterdeck, having saloon and cabins for officers and a few passengers aft, a long bridge of extra strength carried right up to fore hatch, and containing comfortable quarters for the crew. The usual topgallant forecastle is fitted with Emerson, Walker & Co's windlass, working patent stockless anchors. The hull is built on the web-frame principle, dispensing with hold beams and giving a clear hold for working cargo. Five hatches are fitted, four steam winches, steam steering gear, donkey boiler, and double bottom under each hold for water ballast. The boats are carried on beams overhead, and a complete equipment is provided for general trading. Fine triple-expansion engines having cylinders 19 in., 30½ in., and 51 in. diam., with a 36 in. stroke of piston, giving 730 H.P., and two steel boilers to work at 150 lbs. pressure per square inch, are being supplied by the Central Marine Engineering Co., West Hartlepool. She was gracefully christened *Carrie* by Miss Peto, daughter of the Rev. Mr. Peto, of Stockton-on-Tees, and granddaughter of Mr. C. Nielsen, of Hartlepool.

Kinkora.—On September 8th a ship was launched at Maryport from Messrs. Ritson & Co.'s yard. She is 261 ft. long, 39 ft. breadth (moulded), and 23 ft. 6 in. depth in hold. The ship has been purchased by Messrs. Porter & Son, Belfast. She was named the *Kinkora*.

Ceylon.—On September 8th there was launched from the yard of Messrs. John Blumer & Co., North Dock, Sunderland, a screw steamer, of the following particulars:—Length between perpendiculars, 290 ft.; beam, 38 ft.; depth, 19 ft. 7 in., with a short poop for the accommodation of captain and officers, raised deck, and long bridge at the foremast, with accommodation for the crew under the fore-end; a house on deck for the engineers, and a topgallant forecastle. The vessel is classed 100 A at Lloyd's, and is built on the web-frame system, with cellular-bottom fore and aft for water ballast. She is fitted with all the latest improvements, including four steam winches and steam windlass, by Messrs. Clarke, Chapman & Co., Gateshead; Pepper's steam-steering gear, manufactured by Messrs. R. Roger & Co., Stockton; and steering gear aft by Messrs. J. Hastie & Co., Greenock. The engines are by the North-Eastern Marine Engineering Company. On leaving the ways the vessel was named *Ceylon* by Mrs. Boe, wife of Captain Boe, who has inspected the vessel during her construction. The vessel is owned by Messrs. Harloff & Boe, Bergen.

William Branfoot.—On September 10th Messrs. Joseph L. Thompson & Sons launched at the North Sands, Sunderland, the steel screw steamer *William Branfoot*, built to the order of Messrs. Tyzack & Branfoot, of that town. The vessel is of the improved well-deck type, with extended bridge to the fore side of foremast, full poop and topgallant forecastle, having accommodation for captain, officers, and seamen, the engineers being berthed at the after end of the bridge-house. The vessel is of the highest classification, and constructed on the web-frame and intercostal plate system, having frames of the Z section, and the plating of the upper sides of the vessel is of increased thickness. The water ballast tanks extend the full length of the vessel, and are on the cellular double-bottom principle, the holds being subdivided by six steel watertight bulkheads. Four horizontal steam winches will be fitted, also direct steam windlass and steam amidship steering gear, with patent screw gear aft. The engines are of 180 N.H.P., and are built by the North-Eastern Marine Engineering Co. (Limited), of this town, with two steel boilers of the multitubular form, with a pressure of 160 lbs. to the square inch. The naming of the vessel was performed by Mrs. W. J. Branfoot.

Marple.—On September 11th Messrs. Earle's Shipbuilding and Engineering Co., Limited, launched from their yard at Hull the screw tug *Marple*, which has been constructed for the Manchester, Sheffield and Lincolnshire Railway Co. to act as harbour tender to their continental traders and for general towage purposes. Her dimensions are:—Length, 90 ft.; breadth, 20 ft.; depth of hold, 8 ft. 6 in., and she is built of iron and classed with Lloyd's. A comfortable cabin is provided amidships' forming shelter for passengers landing from the company's steamers, while the crew's quarters are under the deck aft. There is a water ballast tank forward to assist in trimming the ship, and she has been fitted with twin-screw engines with the object of getting as much available power as possible on a light draft, so as to enable the vessel to come alongside the piers at all times of the tide, the cylinders being (two) 15 in. and 28 in. diameter by 18 in. stroke, steam for which is supplied from a steel boiler of large size. For salvage and fire purposes she will also have in the engine-room a very powerful pump of special design by Tangye's, Limitod.

Erimus.—On September 17th there was launched from the yard of Messrs. Raylton Dixon & Co. a paddle ferryboat, which has been built for the Middlesbrough Corporation, intended for the service between Middlesbrough and Port Clarence, and arranged for the conveyance of passengers and horse and cart traffic. The vessel is of the following dimensions: Length, 99 ft. 6 in.; breadth, 30 ft. 3 in.; depth, 6 ft. 9 in. She has a large house on deck for passengers, with a promenade deck on top. Her engines, which are by Messrs. Westgarth, English, and Co., of Middlesbrough, will have two cylinders of 26 in. diameter by 42 in. stroke. On leaving the ways she was gracefully

christened the *Erimus* by Miss Mildred, daughter of the chairman of the Ferry Committee.

Patapsco.—On September 18th there was launched from the Deptford Yard, Sunderland, the second of two steel steamships built by Mr. James Laing to the order of the Neptune Steam Navigation Company, Limited, of which Messrs. W. & T. W. Pinkney, of Sunderland, are managers. This vessel has been specially built for service on the company's Neptune line between Baltimore and Rotterdam, but it is equally well suited for all other cargo-carrying trades, and can be adapted for emigrants if necessary. Her dimensions are:—Length, 311 ft.; breadth, 38 ft. 4 in.; depth, 27 ft. 3 in. She is fitted with Emerson, Walker & Co.'s patent direct-acting steam windlass and capstan, and Donkin & Nicol's patent steam steering gear. She is built under special survey to class 100 A1 at Lloyd's, and has a deadweight capacity of 3,600 tons. Her engines, being built by Mr. George Clark, of Southwick, are tri-compound, and of the following particulars:—Cylinders, 22 in., 36½ in., and 60 in., with 39 in. stroke, and are to indicate 1,100 H.P. She is in all respects a sister-ship to the *Ohio*, launched a few weeks ago for the same company. As the vessel left the ways she was named the *Patapsco* by Mrs. William Briggs, of Brinnington Hall, Stockport, the wife of one of the directors of the Neptune Company.

Iron Screw Steamer.—On September 20th there was launched from the shipbuilding yard of Messrs. Schlesinger, Davis & Co., a handsomely-modelled iron screw steamer. The principle dimensions of the vessel are as follows:—Length between perpendiculars, 260 ft.; breadth, moulded, 36 ft.; depth, moulded, 20 ft. 2 in. She is built with a poop, long raised quarterdeck, bridge, and topgallant forecastle, and is rigged as a two-masted schooner; she is fitted in the holds and after peak for water ballast. All the most modern improvements have been introduced for the rapid loading and discharging of cargo, including four powerful steam winches by Messrs. Clarke, Chapman, Parsons & Co., steam steering gear by Messrs. Donkin and Nichol, Newcastle-on-Tyne, patent windlass by Messrs. S. Baxter & Co., London. Accommodation for the captain is provided under the full poop aft, the officers' and engineers' berths being fitted under the bridge deck at the after end. The crew are berthed under the topgallant forecastle. The vessel will be fitted with compound surface-condensing engines, with cylinders 33 in. and 63 in. diameter by 39 in. stroke, by Messrs. Black, Hawthorn and Co., Gateshead. The vessel was not named.

Smeaton.—On September 20th there was launched from the yard of Messrs. John Blumer & Co., Sunderland, a screw steamer of the following description:—Length between perpendiculars, 250 ft.; beam, extreme, 35 ft. 6 in.; depth, 15 ft. 10 in.; short poop for captain and officers; raised quarterdeck; long bridge, with accommodation for crew under; and topgallant forecastle. She is built on the web-frame system, with cellular bottom for water ballast, and is fitted with all the latest improvements, including four steam winches by Messrs. R. Roger & Co., Stockton, Pepper's patent steam steering gear amidships, and hand steering gear by Messrs. J. Hastie & Co., Greenock; windlass by Messrs. Clarke, Chapman & Co., Gateshead. The engines are of 140 N.H.P., by the North-Eastern Marine Engineering Co., Wallsend. On leaving the ways the vessel was named *Smeaton*. She is owned by Messrs. Robinson & Co., of Whitby.

Drever.—On September 20th there was launched from the Howdon yard of the Palmer Shipbuilding and Iron Company (Limited), a steel cargo vessel, 220ft. long, 32ft. broad and 17ft. deep. The vessel has a long raised quarterdeck, topgallant forecastle, four water-tight bulkheads, water ballast tanks fore and aft, ranged in double bottom, with deep floors. The gross tonnage of the vessel will be about 800 tons, and she will be fitted with triple-expansion engines of 100 H.P. She has been built to the order of Messrs. John Fenwick & Sons, London, and was named the *Drever*, the ceremony being performed by Mrs. Thompson, of Tyne Dock.

Cyril.—On September 20th Messrs. T. Turnbull & Son launched from their shipbuilding premises, Whitehall, Whitby, a screw steamer, which, as she left the ways, was named the *Cyril*. The dimensions of the new vessel are:—Length over all, 298 ft. 9 in.; length between perpendiculars, 288 ft.; breadth, 38 ft 2 in.; depth from top of floorplate, 20 ft. 11 in. She is classed 100 A1 at Lloyd's, and her deadweight carrying capacity, about 3,350 tons, at 20 ft. 3½ in. Her engines are 175 N.H.P., being constructed by Messrs. Blair & Co., of Stockton-on-Tees. The vessel is built of steel, to the order of Messrs. Turnbull Bros., of Cardiff. The naming ceremony was performed by Mrs. Philip Turnbull, wife of one of the firm.

Launcelot.—On September 20th the Tyne Shipbuilding and Iron Company launched from their yard at Willington Quay a cargo vessel of the following dimensions:—Length, 290 ft.; breadth, 40 ft.; and depth, 27 ft., The vessel will be fitted with all the latest and most approved appliances, and with large and powerful engines by Wigram Richardson & Co. She has been built to the order of Mr. Francis T. Reid, of Leith, and is intended for the general carrying trade, it being estimated that she will carry about 4,000 tons deadweight. As she left the ways the vessel was named the *Launcelot*.

Thorntondale.—On September 20th there was launched from the shipbuilding yard of Messrs. John Readhead & Co., West Dock, South Shields, a steel screw steamer of the following dimensions, viz.:—290 ft. by 39 ft. by 21½ ft., and classed 100 A1 at Lloyd's, under special survey. The vessel has a poop, long bridge amidships, topgallant forecastle, and is of the improved well-decked type, water ballast in cellular bottom. She is fitted with every appliance for economical working, and fitted with shifting boards and bulkheads to comply with the requirements of Grain Cargo Act. She is fitted with triple-expansion engines, also built by Messrs. Readhead, with cylinders 23 in., 37½ in., and 61½ in., and 39 in. stroke, which are supplied with steam at 160-lb. pressure from two large steel boilers. The vessel has been built to the order of Messrs. Pantland Hick, jun., & Co., Scarborough, being the sixth steamer built by Messrs. Readhead for this firm, and was named the *Thorntondale* by the Mayoress of Rochdale (Mrs. John E. Petrie). The vessel is intended for the American and general trades, and will be commanded by Captain B. W. Hick.

Hawkhurst.—On September 20th Messrs. Richardson, Duck and Co. launched from their building yard at South Stockton a fine steel screw-steamer of the following dimensions:—Length over all, 307 ft. 4 in.; breadth, extreme, 40 ft.; depth in hold to tank top, 19 ft.; gross register tonnage, about 2,340 tons. The vessel, which has been built to the order of Messrs. Carlisle & Co., London, is of the raised quarterdeck long bridge type, and has a large deadweight carrying capacity. She is fitted with water ballast, all fore and aft on the cellular principle, has a steam-steering gear, stockless anchors, patent self-closing freeing ports, and all modern improvements. She will be fitted with triple-expansion engines, 22 in., 35 in., 59 in. by 39 in. stroke, by Messrs. T. Richardson & Sons, Hartlepool. As the vessel was leaving the ways she was gracefully christened the *Hawkhurst* by Miss M. Benington of Stockton-on-Tees. The *Hawkhurst* has been constructed and will be finished under the superintendence of Mr. Cecil P. W. Bond, Consulting Engineer, of 27, Leadenhall Street, London, and of Captain Robertson, who will take command.

Daniel.—On September 22nd the screw steamer *Daniel* was successfully launched from the yard of Messrs. W. Doxford and Sons at Pallion. She has been built to the order of Otto Jaffe, Esq., of Belfast, for the general trades, is entirely of steel, and built to Lloyd's 100 A1 class. The principal dimensions are:—Length between perpendiculars, 280 ft.; breadth, extreme, 38 ft. 3 in.; depth, moulded, 21 ft., with cellular bottom fore and aft. The engines are triple-expansion, three cranks, with all Messrs. Doxford's latest improvements, the cylinders being 21, 35, and 57 in. diameter respectively, and the stroke 39 in.; they are supplied with high-pressure steam from exceptionally large boilers. She is fitted with Messrs. Bow McLachlan's patent steam steering gear and Hastie's screw gear aft, and has two 8 by 12 and two 6 by 10 horizontal steam winches by Messrs. Welford Bros., of Pallion, with all the most recent improvements for cargo purposes. The cabins are most tastefully constructed in hard-wood in the bridge, and give comfortable quarters for the captain and officers; engineers are berthed in after end of bridge, and crew in forecastle. The christening ceremony was most gracefully performed by Mrs. Daniel Jaffe, of Belfast.

LAUNCHES.—Scotch.

Foohng Suey.—On August 23rd the launch took place from Messrs. Napier, Shanks & Bell's shipyard, at Yoker, of a steel barque, named the *Foohng Suey*, of 1,000 tons nett, built for Messrs. C. Brewer & Co. (Limited), of Honolulu, Hawaiian Islands. The *Foohng Suey* is classed 100 A1 at Lloyd's, furnished with all modern improvements, and, while having a large carrying capacity, is also expected to prove a fast sailer. On leaving the ways she was named in due form by Mrs. H. M. Napier, of Milton, Bowling.

Lochiel.—On August 23rd there was launched from the building yard of Messrs. Murdoch & Murray, Port Glasgow, a large steel screw steamer of the following dimensions, viz.:—279 ft. by 37 ft. 8 in. by 20 ft. 6 in. depth of hold; gross tonnage 2,100 tons. The vessel has been built to the highest class at Lloyd's under special survey, and has raised quarterdeck, poop, long bridge, and topgallant forecastle, cellular water ballast throughout, Davis's steam-steering gear, Napier's steam windlass, and steel masts and yards. She will be a large carrier on a light draught, and is fitted with all the latest improvements for the rapid discharging of cargo. She is also fitted for carrying grain, the hatches being large to act as grain feeders. Particular attention has been given to ventilation throughout the entire ship. The vessel has been built to the order of Messrs. James Gardiner & Co., Glasgow, under the personal supervision of Captain Gibb. As the vessel left the ways she was named the *Lochiel* by Mrs. Gibb, wife of the owner-superintendent, and was then taken in tow for Glasgow, where her machinery, consisting of triple-expansion engines to indicate 1,600 H.P., steam winches, &c., will be supplied by Messrs. Ross & Duncan, engineers, Govan.

Rollo.—On August 25th Messrs. John Cran & Co., Albert Engine Works, Leith, launched an iron screw steamer named the *Rollo*, built to the order of Mr. J. Constant, London. The vessel, which is intended for towing purposes, is 60 ft. in length, 14 feet in breadth, and 8 ft. in depth, and is to be supplied by the builders with compound surface-condensing engines, having cylinders 11 and 22 by 18 in.

Ormea.—On August 27th a twin-screw steam yacht, built to the order of Mr. William Huteson, Rothesay, was launched from the Ardrossan Shipbuilding Company's yard. Her dimensions are:—Length, 148 ft.; breadth, moulded, 22 ft.; depth, 13 ft. 6 in.; and registered tonnage, 304 tons. She is built on a special survey, and classed 100 A1 at Lloyd's. Mr. Robert Kent designed her and superintended her construction. She is built of steel, and is fitted with the most modern appliances, including combined winches and windlass. She will have two funnels, and be rigged as a fore-and-aft schooner. Messrs. Mure & Houston, Glasgow, will supply the engines, which will be of nearly 700 H.P. On leaving the ways the vessel was named the *Ormea* by Miss Taylor, Hanley, Staffordshire.

Hermes.—On August 27th Messrs. William Denny Bros., Dumbarton, launched a steel built sailing schooner of 215 tons measurement for the River Plate service. She was named the *Hermes* by Miss Ward, Rockvilla, Dumbarton, daughter of one of the partners of the firm.

Andrew Welsh.—On August 30th Messrs. Russell & Co. launched from their yard at Kingston, Port Glasgow, a barque of the following dimensions:—Length, 195 ft.; breadth, 36 ft.; depth, 18 ft. 9 in. On leaving the ways the vessel was named *Andrew Welsh*, and is built to the order of Captain Marston, San Francisco, for the trade between that port and Honolulu. She will complete her outfit in the East Harbour.

Amaranth.—On September 3rd Messrs. Alexander Stephen and Sons launched from their shipbuilding and engineering works at Linthouse a handsomely-modelled steel screw steamer of about 4,000 tons deadweight carrying capacity, built to the order of J. Bruce Murray, Esq., 65, Great Clyde Street, Glasgow. The vessel, which is intended for general trade, has been built under special survey of Lloyd's for their highest class of 100 A1, three-deck rule, and is constructed with extra heavy main framing and longitudinal intercostals, dispensing with hold beams, thus giving large unobstructed hold for the bulkiest cargo. The vessel has poop, bridge and topgallant forecastle. At fore end of bridge accommodation of a superior description has been provided for captain, with staterooms for passengers, officers and engineers. The vessel has a double bottom on the cellular principle for water ballast, and is fitted with steam and hand steering gear, steam windlass, steam winches, and all the most approved appliances for the economical working of ship and cargo. The engines, which were fitted on board before launching, are of the most improved triple-expansion type, having cylinders 23 in., 37 in. and 59 in. diam. and 42 in. stroke, with two steel boilers suitable for 160 lbs. working pressure. As the vessel left the ways she was named the *Amaranth* by Mrs. Murray.

Duncan.—On September 3rd a twin-screw tug, built by Messrs. Pearce Brothers, Dundee, to the order of the Dundee Harbour Trustees, was launched from Craigie Shipyard. The vessel is of steel, and has been built under special survey to class 100 A1 at Lloyd's, and to have a passenger certificate from the Board of Trade for twelve months. Her dimensions are:—Length between perpendiculars, 120 ft.; breadth, moulded, 24 ft.; depth of hold, 11 ft. 3 in.; gross tonnage 225. She has a sheer of about 30 in. forward and 20 in. aft, and her draught with 10 tons of coal in her bunkers, and her steam up, will not exceed 6½ ft. Water ballast tanks are provided forward and aft of such capacity as to increase the vessel's mean draught to 8 ft. 6 in., and put her in good sea-going trim. She will be fitted with two sets of triple-expansion engines, each engine to be of 48 N.H.P., 250 actual, and each set being distinct and independent. A speed of 10 or 11 knots is anticipated. The cylinders will be three in number—12 in., 17 in., and 30 in. diameter, and 20 in. stroke. Her boiler will be of steel, 13 ft. diameter, 10 ft. 6 in. in length, with three furnaces about 40 in. diameter, each having separate combustion chambers. It has been tested to withstand a pressure of 320 lb. per square inch, and the working pressure will be 160 lb. The tug will have all the necessary fittings, including steam winch and windlass combined, Emerson, Walker & Co.'s patent, and derrick capable of lifting five tons. There will be ample saloon accommodation, and the vessel can be used for salvage or deep-sea towing purposes. On leaving the ways the vessel was named the *Duncan* by Mrs. Hunter, wife of Provost Hunter.

Conquistador.—On September 3rd Messrs. A. M'Millan & Son, of the Dockyard, Dumbarton, launched an iron screw steamer of 1450 tons gross, of the following dimensions, viz:—240 ft. by 33 ft. by 21 ft. 1 in. The vessel, which has been built to the order of Messrs. Perez, Hermane, Valencia, will be fitted by Messrs. D. Rowan & Son, Glasgow, with triple-expansion engines having cylinders 17 in., 27 in., and 44 in. by 3 ft. stroke, with pressure at 160 lb., and capable of developing a speed of 12 knots. The vessel was named the *Conquistador* by Miss Addele Colls, of Denmark Hill, London.

Stormlight.—On September 3rd Messrs. Scott & Co. launched from their shipbuilding yard at Greenock a steel screw steamer, named the *Stormlight*, which was built to the order of Messrs. Ross & Marshall, stevedores and shipping agents, Greenock. The new steamer has been specially constructed for salvage work, and is of the following dimensions:—Length, 70 ft.; breadth, 18 ft. 6 in.; and depth, 9 ft. She has been supplied with compound surface-condensing engines, with a working pressure of 160 lb. to the square inch. She has also been fitted up with water ballast, which will enable her to proceed to the scene of a wreck without taking in cargo.

Petrel.—On September 6th Messrs. John Cran & Co., engineers, Leith, launched an iron screw steamtug, named the *Petrel*, 60 ft. in length, 14 ft. in breadth, and 8 ft. in depth, built to the order of Mr. J. Constant, London. The tug will be supplied with compound surface-condensing engines by the builders.

Foam.—On September 6th a steam launch, 35 ft. keel, belonging to Sir Spencer Wilson, Achany shootings, was launched on Loch Shin, under the superintendence of Mr. D. D. Eason, engineer, Aberdeen. The launch was successfully accomplished, and the *Foam* gracefully took the water in presence of a large number of spectators. This is the third steamer which has been on the loch during the last twenty years.

Adirondack.—On September 7th Messrs. Aitken & Mansel launched from their Whiteinch yard a steel screw steam vessel of 2,300 tons. Dimensions:—290 ft. by 37 ft. by 24 ft. 6 in., with triple-expansion engines, having cylinders 25 in., 41 in. and 67 in. diameter, by 42 in. stroke, having saloon and sleeping accommodation for 50 first-class passengers, and fitted with electric lighting and other appliances of the most modern description. This vessel, which has been built to the order of Messrs. Leech, Harrison & Forwood for the Atlas Steamship Company, Limited, of Liverpool, was named the *Adirondack* by Lady Forwood. The engines will be fitted by Messrs. John and James Thomson, and the entire vessel has been supervised throughout by Mr. Wm. Esplen, of Liverpool. When completed, she will be added to the Atlas Company's fleet of vessels engaged in the mail, passenger, and carrying service between New York and the West Indies.

Ethel.—On September 7th there was launched from the shipbuilding yard of the Grangemouth Dockyard Company a steel screw steamer, built to the order of Messrs. William Christie and Co., of London, of the following dimensions:—Length, 150 ft. between perpendiculars, by 35 ft. by 19 ft., moulded, and about 2,200 tons deadweight capacity. The vessel has a long, raised quarterdeck, bridge, and topgallant forecastle; cellular double bottom throughout, for water ballast, steam steering gear, by Allen and M'Lellan, Glasgow, steam windlass by Napier Brothers, and

all the latest improvements for working both ship and cargo, and specially adapted for Messrs. Christie's sleeper trade. She is to be fitted with a set of triple-expansion engines by Messrs. Hutson and Corbett, Kelvinhaugh Engine Works, Glasgow—cylinders, 18 in., 30 in., and 44 in. by 36 in. stroke, with steam at 160 lb. pressure. On taking the water the vessel was named the *Ethel* by Miss Christie, daughter of the owner.

Wooden Steam Vessel.—On September 8th Messrs. Marr Brothers launched from the Sandport Slip at Leith a wooden steam vessel 55½ ft. in length, 10½ ft. in breadth, and 6 ft. 6 in. in depth. The vessel, which has been built for Her Majesty's Customs at Shields, will be engined by Messrs. Hawthorns and Co., Leith.

Cape Horn.—On September 8th Messrs. Russell & Co. launched at Port Glasgow the four-masted steel sailing ship *Cape Horn* for Messrs. Bordes, of Bordeaux, 310 ft. by 44½ ft. by 24½ ft., to carry 4,400 tons deadweight. This vessel has been built to the highest class at Lloyd's and Veritas, is fitted with cellular bottom to hold 600 tons water, and midship tank in addition to hold 1,100 tons of water ballast—this tank will be used also for cargo—four steam winches, direct steam windlass, and elaborate pumping arrangement for water ballast. She has been contracted for and built under the directions of Messrs. David Bruce & Co., of Dundee, Messrs. Bordes' representatives in this country. She was launched and named by Madame Voisin, wife of Captain Voisin, who is to command.

Baron Douglas.—On September 8th Messrs. Murdoch and Murray, shipbuilders, Port Glasgow, launched from the yard of Messrs. Blackwood & Gordon a screw steamer of the following dimensions, viz.:—Length between perpendiculars, 300 ft.; breadth of beam inside, 40 ft.; depth of hold from top of floors to upper deck, 24 ft. 9 in.; gross tonnage, about 2,700. The vessel has been built to the highest class at Lloyd's under special survey, and is certified to carry grain cargoes in bulk. She has a poop, bridge, and topgallant forecastle, and is fitted for water ballast throughout on the cellular system. She has been fitted with all the latest improvements for the rapid loading and discharging of cargo, has four powerful steam winches, one of Clarke Chapman's steam steering gear. Her machinery, which is on the triple-expansion principle, consisting of engines with cylinders 22 in., 35 in., and 57 in., by 42 in. stroke, and two large boilers will be supplied and fitted on board by the builders. The vessel has been built to the order of Hugh Hogarth, Esq., Glasgow and Ardrossan, and on leaving the ways was named the *Baron Douglas* by Miss Hogarth.

Doris.—On September 10th there was launched from the yard of Messrs. R. Duncan and Co., Port Glasgow, a steel screw steamer of the following dimensions:—Length, 260 ft.; breadth, 37 ft.; depth 24 ft. 9 in., and of the deadweight carrying capacity of 2,760 tons. She has been built to the order of Messrs. Aitken and Walker, Glasgow, and on leaving the ways was named *Doris*. Messrs. Muir and Houston, Glasgow, will supply the engines, which will be on the triple-expansion principle, with cylinders 18 in., 29½ in., and 47 in. by 39 in. stroke.

Syriam.—On September 10th Messr. Wm. Denny and Bros. launched from the Leven shipyard, Dumbarton, the *Syriam*, a twin screw steamer, intended for the trade of the Irrawaddy Flotilla Company (Limited), of Rangoon. The ceremony of naming the vessel was performed by Mrs. Crichton, sister of Mr. George J. Swann, C.I.E., general manager of the Company.

Bramble.—On September 19th the Campbeltown Shipbuilding Company launched from their yard at Trench Point, Campbeltown, a screw steamer named the *Bramble*, which has been built to the order of Messrs. P. H. Dixon & Co., of Glasgow, for general trading purposes. The *Bramble* has been built under Lloyd's special survey to class 100 A1, and is fitted with steam steering gear, cellular bottom throughout, and all the latest improvements. Her dimensions are 260 ft. by 37 ft. by 19 ft. 2 in. Will be fitted with triple-expansion engines, having cylinders 18 in., 29 in., and 46 in. by 36 in. stroke. The naming of the vessel was performed by Miss Tindie B. Mactaggart, of Drumfin, Campbeltown.

Glenelg.—On September 20th Messrs. Charles Connell & Co., Scotstoun shipbuilding-yard, launched for Messrs. James Gardiner & Co., Glasgow, a steel screw steamer of the following dimensions:—300 ft. by 40 ft. by 25 ft. 6 in., and measuring about 2,750 tons gross register. She has been built to Lloyd's highest class under the three-deck rule, and is fitted with water ballast fore and aft, and all the latest improvements. Her engines are of the triple-expansion type, having cylinders 23 in., 37 in., and 59 in. by 42 in. stroke, and are being supplied by Messrs. Duncan, Stewart & Co., London Road Ironworks. As the vessel left the ways she was named *Glenelg* by Mrs. J. G. Gardiner, Brechin.

Darien.—On September 20th there was launched from the shipyard of Messrs. Barclay, Curle & Co., Limited, Whiteinch, Glasgow, a steel screw steamer built to the order of the West India and Pacific Steamship Company, Limited, of Liverpool, and intended to trade between Liverpool and West Indian and Mexican ports and New Orleans. The vessel, which is a duplicate of the *William Cliff*, lately finished for that company by the same builders, will be provided with accommodation for 50 first-class passengers, and is to be entered on Admiralty list for transport service, and will be fitted as required by American Passenger Act (in addition to the usual Board of Trade requirements), and with the most modern improvements and appliances suitable to the trade. The dimensions of the steamer are 370 ft. by 41 ft. by 27 ft. hold, and will register about 3,400 tons, and will be fitted by the builders with triple-expansion engines of about 2,000 H.P. On moving on the ways the vessel was named the *Darien* by Miss Minnie Ferguson, Larkfield, Partick.

Atrato.—On September 22nd Messrs. Robert Napier & Sons launched from their shipbuilding yard at Govan, the *Atrato*, a magnificent steel screw steamer of about 5,350 tons gross for the Royal Mail Steam Packet Company, London. This vessel is the first of two steamships which Messrs. Napier are building for that company's Brazil and River Plate service, and as speed is an important element, the hulls have been designed upon fine lines. A handsome clipper bow and figurehead give the ship a most symmetrical appearance. Her general dimensions are:—Length on load line, 400 ft.; breadth (extreme), 50 ft.; depth to spar deck, 33 ft. 6 in.: and she is built to class 100A at Lloyd's under special survey. To attain a high rate of speed with the greatest possible economy, the builders will supply the vessel with triple-expansion engines capable of indicating 6,000 H.P., steam being supplied by eight single-ended boilers at a working pressure of 150 lb. The accommodation for passengers will be of a luxurious description, and all the details are carefully considered with special reference to a first-class service in a hot climate. To admit of perfect ventilation, the dining-saloon has been placed on the upper deck, and is arranged with numerous tables and revolving chairs, so that family parties can dine together as in the most modern hotels. The sides of this saloon will be finished with polished hardwood with carved walnut panels, and the ends will have artistically designed sideboards, glass racks, &c., with an organ at the forward end, while the large square windows will give abundance of light and ventilation. A double staircase leads to the music-room on the promenade deck, which will be finished with birds'-eye maple, and supplied with the piano which obtained the gold medal at the Colonial Exhibition in London. Very complete accommodation for second-class passengers has been fitted aft, including dining-saloon, ladies' cabin, and smoking-room. Accommodation will also be provided for 400 third-class passengers, and the officers' quarters have had special consideration for their comfort. The *Atrato* will be supplied with all requisite appliances of the most improved description for working ship and cargo.

Cabral.—On September 24th Messrs. Scott & Co., shipbuilders, Greenock, launched a steel screw-steamer of 750 tons. She is named *Cabral*, and is built for Messrs. Megaw & Norton, London, and is intended for the Brazilian trade. Her engines, which are 600 H.P., are on the triple-expansion principle.

LAUNCH—Danish.

Valkyrien.—On September 8th there was successfully launched at the royal dockyard, Copenhagen, the new Danish warship, the *Valkyrien*. The engines as well as boilers for this boat have been made at the large establishment of Messrs. Burmeister & Wain, of Copenhagen. The *Valkyrien* is built entirely of steel, and is not armoured, but has a protective armour deck of 2½ in. thickness, slightly arched, commencing at about 4 ft. under the water's edge and rising to within 6 in. of the water line. The boilers are six in number, and the two engines will together indicate 5,000 H.P., which is calculated to produce a speed of 17 knots. The *Valkyrien* has a powerful ram, the point of which is about 8 ft. below the water's edge.

LAUNCH—American.

Baltimore.—On August 28th the cruiser *Baltimore* was launched from the yard of Messrs. W. Cramp & Sons at Philadel-

phia. She is one of the fast heavily armed vessels building for the American navy. Her principal dimensions are:—Length between perpendiculars, 315 ft.; over all, 335 ft.; beam, 48 ft. 6 in.; displacement, 4,400 tons, on a draught amidships, when fully equipped, of 19 ft. 6 in. The *Baltimore* is an unprotected vessel, but she has an armoured deck, a conning tower with 3 in. of armour, and bullet-proof tops on her masts. She is intended for a flag-ship, which will carry the commander-in-chief of the station to which she may be attached. The engines are of the triple-expansion type, two in number, and placed in separate water-tight compartments. Steam is supplied by four boilers. The I.H.P. of the engines, under ordinary draught, is 7,500, brought up to 10,750 H.P. when the forced draught is applied, and when the cruiser will reach a speed of 19 knots. With 850 tons of coal on board, her utmost bunker capacity, she will be able to run 10,445 knots, at a speed of eight knots an hour. The *Baltimore* will be lighted by electricity. Her armament will consist of four 8-in. breech-loading guns, six 6-in. breechloaders, six 6-pounder quick-firing, six Hotchkiss revolver guns, four Gatlings, and five torpedo-launching tubes.

TRIAL TRIPS.

Framnes.—On August 23rd the s.s. *Framnes*, recently launched from the building yard of Messrs. Wood Skinner & Co., Bill Quay, proceeded to sea for a loaded trial trip with a large party on board. The *Framnes* is a fine specimen of a modern steel cargo vessel, with long raised quarterdeck, bridge and topgallant forecastle, and has been built to the order of Messrs. Fearnley & Eger, of Christiania, a well-known firm of shipowners, who are thus increasing their fleet at a time when the prospects are improving. The *Framnes* is built to the highest class at Lloyd's and also in Norwegian Veritas, for whom the vessel has been surveyed while building by Mr. Lauritz M. Bodin, the resident surveyor in England, and is 270 ft. long over all, 35 ft. beam, and 19 ft. 2 in. depth, moulded, and at the time of her trial was loaded with 2,431 tons deadweight, which was rather over the contract quantity. The engines have been constructed on the triple-expansion system by the North-Eastern Marine Engineering Co., Wallsend, and during the trial indicated over 800 H.P., and propelled the vessel at an average speed of 9¼ knots, which was deemed highly satisfactory by all on board, and the trial trip was entirely successful throughout, not the slightest hitch of any kind occurring. After carefully adjusting compasses and taking some instantaneous photographs of the vessel steaming full speed by Mr. Parry of South Shields, the *Framnes* took her departure for Stockholm under the command of Captain O. Thorbjornsen.

Viera y Clavijo.—On August 24th the trial trip of this steamer, belonging to Messrs. Elder, Dempster & Co., of Liverpool, took place on the Clyde. The *Viera y Clavijo* is the second of a fleet of steamers which is to perform a regular service between the islands of the Canary group. The *Viera y Clavijo* is a steamer of 620 tons B.M. At her trial, on the measured mile, she accomplished 12·72 knots, besides showing herself a capital sea boat.

Alphonso XII.—On August 25th, the Spanish mail steamer *Alphonso XII.*, built by Messrs. Wigham Richardson & Co., Low Walker, said to be the largest merchant vessel that has been constructed on the Tyne, was taken on a trial trip to sea. She was launched about five months ago. The following is the official description of the *Alphonso XII.*:—Length over all, 426 feet; length between perpendiculars, 393 feet; beam moulded, 47½ feet; depth moulded, 36 feet. She will be classed either at Lloyd's or with the Veritas of the highest character, and built of Siemens-Martin steel. The bottom is cellular and double. There are three iron decks, all sheathed, the upper with teak, and an orlop deck below. She is built in the old style, with a clipper bow. Her gross tonnage will be over 5,000 tons, and her engines will indicate 4,500 horses, capable of driving her from 15 to 16 knots an hour. She is intended for the mail service between Spain and the Antilles, and is fitted for 240 passengers and 800 emigrants, besides the ship's company of nearly 150. The engines and boilers are of the builders' own make. The boilers are of steel, and will be fitted to work with forced draught if so required. The decks are arranged to mount guns in case of need. All the unloading and loading, as well as the steering, will be noiseless, being effected by hydraulic gear. The lighting throughout will be by electricity. The vessel will trade directly between Cadiz and Cuba. She is owned by the Compania Transatlantica, and, as a return for a subsidy granted by the Spanish Government, she is so fitted that she will be available, in case of war, as an armed cruiser. Although her speed, with natural draught, will be from 15 to 16 knots, she will be capable, with forced draught, of developing a still higher rate of progression.

Trewavas.—On August 27th, the trial trip of the steel screw steamer *Trewavas*, built by Messrs. Readhead & Co., South Shields, to the order of Messrs. Hain & Son, St. Ives, took place off the Tyne. The dimensions of the vessel are as follows:—Length, 259 feet; breadth, 36 feet; depth of hold, 19 feet; she has a long raised quarterdeck, bridge, and topgallant forecastle, cellular bottom for water ballast fore and aft, and is fitted with shifting boards, as required by the Grain Cargoes Act. The engines, also constructed by Messrs. Readhead & Co., are on the triple-expansion three-crank principle, and have cylinders of 20½, 33½, and 55 inches respectively, with a piston stroke of 36 inches. They work at a pressure of 160 lbs. The steamer was run several times over the measured mile, and an average speed of 11 knots an hour was registered. After the trial, which was made under favourable weather conditions, the vessel was taken into Tyne Dock to load a cargo of coals for an Italian port. The *Trewavas* is the 15th vessel constructed by the same builders for Messrs. Hain & Son. She has been specially designed for the Black Sea trade.

Antrim.—On August 28th the s.s. *Antrim*, recently launched by MacIlwaine, Lewis, & Co., Limited, for the Antrim Iron Ore Company, went down Belfast Lough for trial, the mean of several runs on the measured mile giving a speed of over 11¼ knots per hour. The *Antrim* is built of steel, and is specially adapted for the coasting trade, having water ballast in double bottom and in peak tanks. Her dimensions are 174 ft. by 26 ft. by 13 ft. 5 in., moulded, and she will carry about 600 tons deadweight. The engines, which were supplied by the builders, are triple compound, 17 in., 27 in., and 44 in. diameter, and 30 in. stroke, with three cranks, steam at 160 lbs. pressure being supplied by a large three-furnace boiler. The machinery worked in the most satisfactory manner, and steam was easily maintained at full working pressure.

Eton.—On August 30th the steamship *Eton*, which has been built by Earle's Shipbuilding and Engineering Company, Limited, to the order of Mr. Henry Smethurst, jun., of Grimsby, was taken on her trial trip. She is built of iron to Lloyd's highest class, and is generally similar to the steamship *Virgo*, which was constructed last year by Earle's Company for the Grimsby and North Sea Steam Trawling Company. She left at 10.30 for a run on the measured mile at Withernsea to test her speed, and for the purpose of satisfying the purchasers as to her seagoing qualities. The result was all that could be desired, the vessel proving herself a splendid seaboat, and the speed on the measured mile being about 9¼ knots.

Ravenna.—On August 31st and September 1st the new steel screw steamer *Ravenna*, built by Messrs. Ramage & Ferguson, Leith, for Messrs. James Currie & Co., Leith, went on a series of speed trials on the Firth of Forth. The results exceeded the expectations of both owners and builders, as the mean of the high-speed runs showed a speed of fully 11¼ knots. A series of trials for the consumption of coal were also carried out, also a six hours' trial of the engines working at full speed, all of which were very satisfactory, the engines throughout working with the utmost smoothness. The dimensions of the *Ravenna* are:—Length, 249 ft. by 33 ft. breadth, moulded, 18 ft. 4 in. depth, moulded. She is propelled by triple-expansion engines, having cylinders 18 in., 30 in., and 48 in. diameter by 36 in. stroke. The *Ravenna* is the second vessel built this year for Messrs. James Currie & Co. by the same builders. Her sister-ship, the *Ancona*, has just completed a most satisfactory voyage.

Thetis.—On September 1st the *Thetis*, 1,156 tons net register, built by Messrs. John Reid & Co., Port Glasgow, for Messrs. Aitken & Walker, Glasgow, went down the river on Saturday noon. After adjusting compasses she went on a trial test on the measured mile with a cargo of 2,850 tons coal, when a speed of 9¼ knots was attained. The engines, which are by Messrs. Muir & Houston, worked smoothly, and the steering gear, which is one of the new Sentinel gears, wrought satisfactorily. The vessel returned to the Tail of the Bank and proceeded last night on a voyage to Odessa, and after discharging cargo there has been chartered to go up the Danube.

Ivy.—On September 1st the new steamer *Ivy*, built by Mr. C. J. Bigger, Londonderry, and engined by Messrs. Lees, Anderson & Co., Glasgow, for the Glasgow, Dublin, and Londonderry Steam Packet Company (Limited), made a successful run on the Firth. The weather was, unfortunately, very unpropitious, heavy rain falling till far on in the evening; but this did not interfere with the record of the new steamer. The *Ivy* steamed down as far as the Cumbrae Lights, where she showed her ability as a fine specimen of naval architecture and marine engineering. The *Ivy*, it may be mentioned, is 190 ft. long over all, 28 ft. broad, 14 ft. 6 in. deep (moulded), and 530 tons gross register. She can carry 50 first-class passengers, and the arrangements for steerage passengers have been made the subject of special study by the builders and owners. She is fitted throughout with electric light by Messrs. W. Harvey & Co., Broomielaw; has Messrs. Muir & Caldwell's steam steering gear, and Messrs. Anderson & M'Kinnell's induced draught ventilation. In reference to the latter patent, it assists very materially in completing arrangements for the safe and comfortable conveyance of live stock, as the cattle may be carried in the hold with closed hatches if necessary. The engines, which are constructed on the triple-expansion principle, are by Messrs. Lees, Anderson & Co., Glasgow, and during the trial on the day previous behaved splendidly. Running the measured mile on Friday over half-a-dozen times, they developed 975 effective H.P., which showed a mean speed of 12.7 knots per hour. With the wind and tide fully 13 knots per hour were covered in three of the runs, a result which was considered very satisfactory. They work up to a pressure of 160 lbs. per square inch. The cylinders are 17½, 28, and 47, with a 36-in. stroke of piston, and a special donkey engine has been fitted for feeding the boilers. In going into details for observation about the coal consumption, it was found that the vessel kept up a speed of 12¾ knots with an average consumption of 16 tons per 24 hours, or about equal to 1·5 lb. per H.P. in the hour. The new steamer is commanded by Captain Kerr, and will shortly be put on her station between Glasgow and Ireland.

Sannesund.—On September 3rd a satisfactory trial took place with the steamer *Sannesund*, which has been re-engined by the Akers Engineering Company, Norway. The engines are on the triple-expansion system, and the boiler intended for 160 lbs. steam. The steamer attained a speed of 10 knots, and the engines worked remarkably well. The Akers Engineering Company have at present in hand three triple-expansion engines, each of 250 H.P., and is, besides, altering the engine of the steamer *Norröna* into a triple-expansion, a third cylinder being placed in front of the two others. The boiler is intended to be worked with 160 lbs. steam, and is being fitted with a forced draught arrangement.

Progress.—On September 3rd the screw steam hopper *Progress*, the first vessel built by Messrs. Ropner & Son, Stockton-on-Tees (successors to the late firm of M. Pearse & Co.), left their shipbuilding yard on her trial trip. She is arranged to dredge on the centrifugal pump principle, and is intended to work as a dredger and hopper combined. She was designed by Mr. John Wilson, C.E., chief engineer to the Great Eastern Railway Company, for which company the boat has been built. She is almost identical in every respect with the *Pioneer*, built in 1886, at the same yard. The latter vessel has given the greatest satisfaction to her owners. She dredges, carries to sea, and puts out about 850 tons per day. The trip passed off in every way satisfactorily. Her engines are by Messrs. Blair & Co. (Limited).

Cranford.—On September 5th the s.s. *Cranford*, built by Messrs. W. Gray & Co., West Hartlepool, and fitted with triple-expansion engines by the Central Marine Engineering Company, went on her trial trip. Her dimensions are:—Length, 300 ft. over all; 38 ft. beam; and 22 ft. 2 in. depth moulded. She takes Lloyd's highest class, and has a large carrying capacity; is of the improved well-deck type, having extra strong bridge extending forward to the fore-hatch. The poop aft contains a saloon and accommodation for officers and a few passengers. I.H.P. 1,100, with boiler pressure 160 lbs. to the square inch; 1,250 tons deadweight were put on board for the trial, and after running a number of times across the measured mile, the vessel attained a speed of 11¼ knots without opening out the engines to their fullest capacity.

Islander.—On September 7th the trial trip of the s.s. *Islander* took place on the Clyde. The steamer ran down to Arran, and sailed up Lochfyne for a few miles, and then returned, reaching the Tail of the Bank at half-past six. The weather was good, with a fine swell on, the fine ship behaving well. The steel twin-screw steamer *Islander* is a vessel built by Messrs. Napier, Shanks & Bell, of Yoker, to the order of the Canadian Pacific Navigation Company, Limited, of Victoria, British Columbia, and is specially designed to meet the requirements of its service in the rapid and comfortable conveyance of passengers between Victoria, British Columbia, and Vancouver, the terminus of the Canadian Pacific Railroad, a distance of about 80 miles. The dimensions of the vessel are:—Length, 240 ft.; breadth, 42 ft.; depth to main deck, 14 ft. 8 in.; gross tonnage, 1,600 tons. The draught of water being limited, owing to certain shallows, or bars, found in the navigation, it has been necessary to use twin propellers, which are driven by two sets of triple-expansion engines, indicating 3,000 H.P., and estimated to ensure a speed of from 15 to 16 knots per hour. The machinery, which has been constructed by Messrs. Dunsmuir & Jackson, Govan, consists of two sets of inverted triple-expansion surface-condensing engines (each set being complete in itself and independent of the other), the engines being supplied with steam by four large steel boilers. The cylinders are of the following dimensions:—High pressure cylinders, 20 in. diameter; intermediate pressure, 31 in. diameter; and low pressure, 52 in. diameter—all having a stroke of 36 in. The high-pressure cylinders are fitted with hard cast-iron liners, and have piston valves. The intermediate and low-pressure cylinders are worked by slide valves, that for the low-pressure cylinder being double ported. The high-pressure pistons are fitted with Ramsbottom rings, and the intermediate and low-pressure piston with Lockwood & Carlisle's patent packing. Electric incandescent lamps and electric bells have been fitted throughout the ship by Messrs. Paterson & Cooper, of London and Glasgow. The engines are fitted with patent sight feed lubricators, Messrs. France & Morgan's make, which firm also supplied the duplex reply telegraph. The general arrangement of the vessel embraces ranges of cabins built on the main and the spar decks, American fashion, with a shade or hurricane deck above all, which can be used as a promenade. The hull, of best mild steel, is subdivided by numerous watertight bulkheads. Not being intended for cargo, the hold space is comparatively small, and the whole of the decks and deck houses are devoted to passenger accommodation. The deck fittings include steam steering gear, placed forward, with hand gear aft; steam windlass and capstan forward, and steam warping capstan aft; a complete system of fire-extinguishing pipes and sprinklers, steel small boats, steam heating pipes, &c., all combining to make the *Islander* a vessel of the highest class. It may be added that she is under the command of Captain George W. Robertson, late of the Cunard service.

Equity.—On September 8th the s.s. *Equity*, which has been built by Earles' Shipbuilding and Engineering Company, Limited, Hull, for the Co-operative Wholesale Society, Limited, of London and Manchester, &c., for their Continental and general trade from Goole, was taken down the Humber for the purpose of undergoing her official trial. A large party had come over from Manchester with the intention of accompanying the ship, and anticipated a pleasant excursion, but in this they were disappointed, owing to the very rough state of the weather, which quite prevented any satisfactory trial being made. The vessel was fully laden ready for going to Hamburg on her maiden voyage, and the average of the run was a speed of about 12¾ knots, but it is confidently expected that better results will be attained when on her station.

Nordkap.—On September 8th the s.s. *Nordkap*, which has been built by Messrs. Raylton Dixon & Co., of Middlesbro', to the order of Messrs. Harloff & Boe, of Bergen, made her trial trip from the Tees. The vessel is of the following dimensions:—Length, 283 ft. 6 in.; breadth, 37 ft.; depth, 21 ft. 9 in.; with a deadweight capacity of over 3,000 tons. The engines, which are on the triple-expansion principle, with cylinders 20 in., 30 in., and 54 in. diameter by 39 in. stroke, have been fitted by Mr. John Dickinson, of Sunderland, and worked most satisfactorily. This is the seventeenth vessel built by Messrs. Raylton Dixon & Co. for Norwegian owners.

Caroline Robert de Massy.—On September 10th the new oil steamer, *Caroline Robert de Massy*, built by Messrs. R. Craggs & Sons, shipbuilders, of Middlesbrough, went out on her trial trip Her dimensions are as follows:—Length, 264 ft. 6 in. over all; width, 37 ft.; depth moulded, 19 ft. 2½ in. She is fitted by Messrs. Westgarth, English & Co., of the same port, with engines having three cylinders, 20 in., 33 in., and 54 in. by 36 in. stroke. Her complement of cargo will be three kinds of oil, in all about 2,150 tons; and 230 tons of bunkers. The ship is arranged in convenient compartments, which are capable of being

rapidly discharged by two Tangye duplex pumps, each rated at 100 tons per hour. She is fitted with the electric light throughout by Messrs. Holmes, of Newcastle. The steamer went north with her oil tanks filled with water, and ran against a strong gale and sea, the measured mile off Whitby, realising a mean loaded speed of 9½ knots; and afterwards a run was made of two hours nine minutes, during which she did the twenty-one miles course on a consumption of 10 tons. She then returned to Middlesbrough and docked to receive coal. The vessel proved a fine sea boat, and although the weather was extremely unfavourable for a speed and consumption test, all parties interested were highly satisfied with both ship and engines. The latter worked admirably, and so smoothly that during the whole run of ten hours without stopping not a jet of water was used. The vessel is owned by the builders, and is chartered to M. A. André fils, of Paris, for four years, to carry oil from Batoum to various ports in France, &c. She sailed on Thursday morning for Batoum, under command of Captain Barclay, late of the s.s. *Fergusons*, which steamer has been carrying oil in bulk for some three years.

Staffa.—On September 11th the steam trawler *Staffa*, built by Messrs. Cochrane, Cooper & Schofield, of Beverley, to the order of Messrs. Charles D. Holmes & Co., Hull, for Messrs. Pickering and Haldane, St. Andrew's Dock, Hull, went on her trial trip. The vessel arrived off Withernsea at 1·40, where she ran the measured mile both ways, the down run being done in 5 min. 17 sec., and the up run in 5 min. 25 sec., giving a mean speed of over 11 knots, which was considered highly satisfactory. The engines, which are of 45 N.H.P., with boilers, were supplied by the contractors, Messrs. C. D. Holmes & Co., and are fitted with all the latest improvements for economy of fuel.

Tangier.—On September 12th this vessel, which has been completed in an exceptionally short time after her launching, was taken out on her trial trip from the yard of Messrs. Doxford & Sons, of Sunderland. The principal dimensions are:—Length, 265 ft.; breadth, 37 ft.; depth, 18 ft. 6 in. with cellular bottom fore and aft. The vessel will carry 2,600 tons deadweight upon 18 ft. draft, and is therefore specially suited for the Black Sea trade, but she is also of sufficient size to compete in the general trades. The engines are triple-expansion with three cranks in line, the cylinders being 21 in., 33 in., and 54 in. diameter, with a stroke of 36 in., working at a boiler pressure of 160 lbs. The bridge being carried as far forward as the foremast leaves her very little well remaining, and the crew are berthed under the forward part of the bridge, the engineers' accommodation being in the aft part of the bridge close by the engine room. The revolutions, with full steam of 160 lbs., and at ballast drafts of 7 ft. 2 in. and 9 ft. 11 in., were 86½ mean per minute, the vacuum being 25 in., and the mean speed on the measured mile 11·28 knots, with a total of 1,050 I.H.P., the engines running smoothly and well. The vessel was built to the order of Messrs. Lamplough & Co., London, under the specifications of Messrs. Flannery, Baggallay & Johnson, and has been purchased for the Angier Line.

Newborough.—On September 14th the trial trip of the steamer *Newborough*, built by Messrs. Gray & Co., of West Hartlepool, for Mr. Councillor C. Furness, had its trial trip in Hartlepool Bay previous to proceeding on her voyage to Genoa. The trip was made in splendid weather and in an almost motionless sea. A run was made in the direction of Saltburn, and afterwards along the coast towards Seaham, when the vessel was put on the measured mile, the speed registered being 10 knots. Her engines are by the Central Marine Company, and are of the triple-expansion class, her cylinders being 19 inches, 30½ inches, and 51 inches in diameter, with 36 inches stroke of piston, giving 700 H.P., and two steel boilers to work at 150 lbs. pressure per square inch.

Amaranth.—On September 17th the new steamer *Amaranth*, built by Messrs. Alexander Stephen & Sons, Linthouse, to the order of Mr. John Bruce Murray, ran her trial trip in beautiful weather. Everything worked most satisfactorily, and the mean speed attained over the measured mile, with about 4,000 tons on board, was 11·18 knots, being over one knot in excess of the contract speed. The *Amaranth* is 2,677 tons gross register, has been specially constructed for the general cargo trade, and goes on her first voyage to Alexandria under command of Captain T. C. Saunders.

Volturno.—On September 17th the s.s. *Volturno*, a new vessel built by Messrs. Richardson, Duck, & Co., of Stockton, for Messrs. Thomas Wilson, Sons & Co., of Hull, left the Tees for her trial trip. Her engines are of the triple-expansion type, of 200 N.H.P., by Messrs. Blair & Co., of Stockton. She made a most successful trip, obtaining a speed of 10½ knots.

Hydra.—On September 18th the steamer *Hydra*, which was launched some time ago from the yard of Messrs. W. H. Potter and Sons, went down the Mersey for the official trial of her machinery. The engines are triple-expansion, three cranks, having cylinders 17, 29, and 46 inches in diameter, with a stroke of 30 inches. The machinery has been supplied and fitted by Messrs. David Rollo & Sons, Fulton Engine Works, the engines being of their well-known design. They have built-up crank shafts, steam reversing gear, and all the latest improvements for the economy of fuel and stores. The boiler is entirely of steel, and built under the supervision of the Board of Trade for a working pressure of 160 lbs. per square inch. It is 14 feet 9 inches mean diameter by 11 feet 7 inches mean length, and has four furnaces 36 inches diameter. The heating surface is 2,200 square feet, and the fire-bar area 72 square feet. On the trial the machinery gave every satisfaction, working with great smoothness, the engines running 93 revolutions, developing 800 I.H.P., the steamer making a mean speed of 11¾ knots per hour. The dimensions of the vessel are:—Length 240 feet, breadth 34 feet, and 16 feet depth of hold. She has been built for the Oceanic Steamship Company, to the order of Mr. Alfred Holt, of Liverpool, and to the specifications and under the personal supervision of Mr. Spenser Wyles, the company's engineer.

Halifax.—On September 22nd the new screw steamer *Halifax*, built by the London & Glasgow Engineering and Iron Shipbuilding Company for the Canada-Atlantic Steamship Company, went down the Clyde on her trial trip. The *Halifax* is a steel vessel of about 1,600 tons, having triple-expansion engines of 3,000 H.P., and boilers to work at 160 lb. pressure. She has been fitted up in a substantial manner, and has every convenience for 424 first-class and 50 second-class passengers, as also accommodation for general cargo. The saloon is unusually high, and is, as well as the state-rooms, handsomely furnished, while the promenade decks are commodious. She is intended for passenger traffic between Boston, Halifax, and Charlottetown, being built by the Canada-Atlantic Company, which has just been formed, as a pioneer on that route, the present steamers plying there being, it is stated, old-fashioned, uncommodious, and altogether unadapted for the trade. The *Halifax*, which is lighted throughout by electricity, ran the measured mile in less than four minutes, her average speed being over 15 knots an hour.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

VARIABLE EXPANSION VALVE GEAR.

To the Editor of The Marine Engineer.

Dear Sir,—I herewith enclose you sketch and particulars of a variable expansion valve gear, invented by me, Drummond A. Murdoch, of Prince's and Clarendon Docks, Engineering Works, Belfast.

The gear has many novel and interesting features, and the motion obtained is an ideal one for a slide valve. I therefore take the liberty of addressing you, in the form of an article, subject to your correction and approval.

IDEAL VALVE GEAR.

Zeuner and other theorists have compiled rules on the slide valve, which have become standing data, for the fixed and unalterable proportions that the lap, travel, compression release, and port opening, all bear to a fixed ratio of expansion. Now it is well understood by all practical men that the excessive lap and travel, early release and great compression, and the diminutive port opening, which these rules demand for this

age of early cut off, and high pressure steam, make the slide valve impracticable for our triple, quadruple expansion engines. The increased size of valve and its lengthened travel for an early cut off is a difficulty not easily overcome, and few (if any) engineers will dare to infringe on the lines and proportions of Zeuner, and thus we see the slide valve fast falling into disrepute.

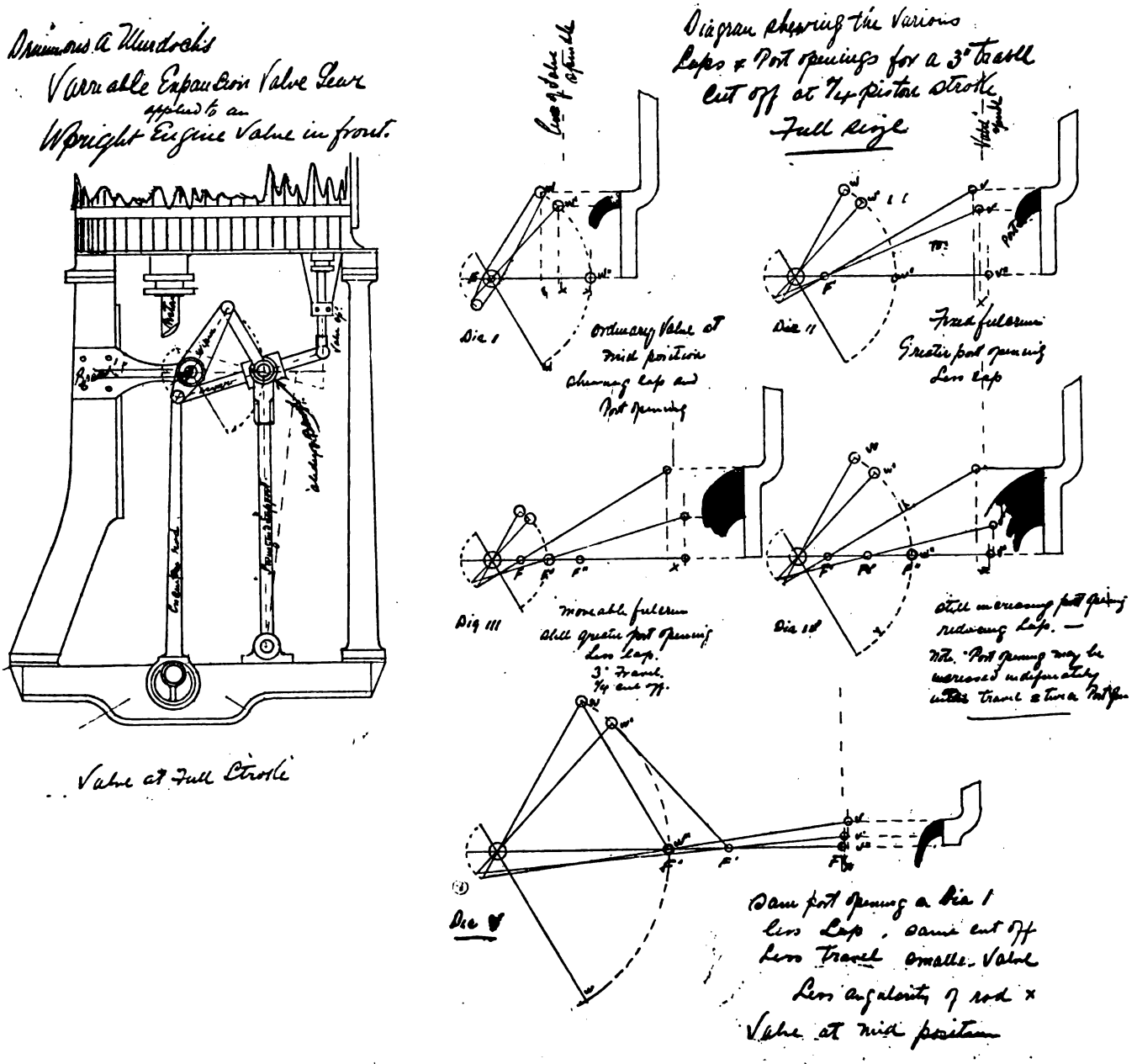
Why not make the slide valve as efficient for high pressure as it is for low? Why not make an early cut off as practical as a late? Why allow the steam to release before it is expanded in work, and then be compressed to disadvantage? Why should we use a large valve if a small one can be applied, and why adopt excessive travel of valve, with all its deleterious results, when a short one will do? A young inventor substantially answers these questions. He attacks the valve at these most vital parts, and puts at defiance all the standard rules of Zeuner *by inventing a variable slide valve gear, that will cut off at any ratio of expansion, with a minimum travel of* TWICE *the* PORT opening. It is important to notice that this travel is not binding for any particular cut off (simply a minimum), as he may *increase* the *travel* indefinitely, without altering the port opening or rate of expansion.

For instance, he may design a valve to cut off at, say, one-fifth stroke, and a port opening of one inch. He may employ a travel of two inch (twice the port opening), or he may increase the travel indefinitely, without interfering with the cut off one-fifth, or the port opening one inch, as they remain *constant* for all *travels*. Thus it will be seen that the *lap* bears no *relationship* to the *ratio* of *expansion*, nor to the angle of advance of the eccentric.

Now this is one great stride towards the advancement of the slide valve, as the advantages gained will be appreciated in both high and low pressure cylinders, and many of your readers will be surprised to see how simply and practically this achievement has been effected.

The manner in which I obtain the above results will be understood by reference to the illustration.

It will be seen that the principle involved is to convey to the valve spindle the constantly varying movements of a lever, acting on a movable fulcrum. Thus, at the commencement of the



stroke the fulcrum is at its greatest distance from the valve spindle, and at the middle of the stroke the fulcrum is close to the valve spindle; therefore at the beginning of stroke or port opening, the fulcrum being at its greatest distance from the valve spindle, the movement is greatest, and the effect on the valve is a speedy opening and closing of port, but as the movements are constantly diminishing towards mid-stroke, the velocity and travel of the valve are correspondingly reduced, so that the motion of the ordinary eccentric is reversed.

The shaft H is an ordinary wiper shaft, oscillating in brackets, fixed to any standing part of engine.

On this shaft is keyed a double-ended wiper; one end of the wiper carries a straight parallel lever, which is connected to the valve spindle; from this lever the valve receives its motion.

I now place on this lever a sliding block, which is fitted to the lever, and at liberty to slide longitudinally along it. This block is provided with a turned axis, on which it oscillates. It is held in position by a jointed support. The axis of the block passing through the joint, this support is either hinged from the sole plate, or suspended from the cylinder like a pendulum.

A short connecting rod connects the end of the wiper to the sliding block, thus the block receives its motion along the lever while it is at the same time acting as a fulcrum for the lever, and as this fulcrum is constantly travelling according to the radius of the wiper, the lever is constantly altering its movements.

The eccentric may be attached to either end of the wiper, or to a special wiper.

Action.—The gear is shown at full stroke of the valve. As the short arm of the lever is ascending it carries the lever with it, making the lever tilt, or oscillate on the fulcrum. The radius of the wiper draws the lever through the fulcrum, thus tending to reduce the movement of the lever at the valve spindle; simultaneously the other end of the wiper is pressing the fulcrum towards the valve spindle. Thus a double action is constantly tending to alter the movements of the lever, while the wiper is tilting the lever on this moving fulcrum, as the gear reaches mid-stroke. The wiper, lever, connecting rod, fulcrum and valve spindle joint all lie along the centre line.

As the end of the wiper passes the centre line, the several parts take up identical positions below the line until full stroke is reached; thus the motion is similar on both sides of the line of mid stroke.

This action is very simple, and the short travel and slow motion at the centre line make it a very smooth working gear, and considerably reduces the wear and tear of moving parts.

This gear is a splendid example, showing how the ordinary eccentric motion may be reversed (a motion detrimental to the working of the steam engine, greatest at mid-stroke and least at full stroke.)

Description of Diagrams.—In Diagrams I., II., III., and IV., a constant travel 3 inch, full size, and rate of expansion ¼ of the piston stroke cut off, is maintained.

Diagram I. is the ordinary slide valve drawn to show and compare the lap, port opening, &c., with my gear for 3 inch travel and ¼ cut off.

Diagram II. is the simple style of my gear, showing the fulcrum fixed at a distance from the wiper shaft. In this modification of the gear, the lever alone has a sliding motion which is according to the radius of the wiper.

A greater port opening and less lap are obtained by this simple gear.

Diagram III. shows the three positions of the valve when the movable fulcrum is employed, a much greater port opening, and less lap is gained.

Diagram IV. shows a still increasing port opening and reducing lap; thus it is clear that by varying the proportions of the gear the lap may be reduced indefinitely small, and that the travel of the valve may be reduced to twice the port opening.

Diagram V. shows a comparison of my gear with the ordinary valve. Diagrams I. and V. have the *same port* opening and *same rate of expansion*. But the small lap, the short travel and diminutive size of valve in Diagram V. are striking and important advantages over Diagram I.

Note 1.—In all the Diagrams W W^1 W^2 represents the wiper, F F^1 F^2 represents the fulcrum, V V^1 V^2 represents the position of the valve spindle joint, at full stroke, at point of cut off, and at mid stroke respectively.

Note 2.—In Diagrams III. and IV. an auxiliary link is employed to bring the fulcrum within the radius of the wiper; the connecting rod is connected to the link.

Note 3.—Diagram V. is a representation of the illustration; no link is here employed. It shows less lap than port opening, for cut off at ¼.

In all the Diagrams X represents the angularity of the connection to the valve spindle, greatest for the ordinary valve and reduced to a straight line in my gear.

From the above set of diagrams it is evident that once the port opening and rate of expansion are settled, the lap is an after consideration—in fact what is deemed necessary for the proper release and compression of exhaust.

The gear is all self-supporting, being held by the brackets and supports; therefore, no extra strain or weight is thrown on the eccentric.

The port is opened and closed when the valve is at its greatest velocity, gradually diminishing until mid-stroke, thus no wire-drawing or throttling the steam.

The gear will cut off at one-twentieth of the stroke with a very diminutive lap, with a late release and no undue compression, points of vital importance in triple and high-pressure engines.

In cases of great danger or emergency the fulcrum is thrown out of gear and held stationary, as in Diagram II., that the steam may be admitted nine-tenths and even full stroke, if necessary for the safety of the ship. Thus the engines can be wrought (in the emergency) at a considerably increased power, of course at a less economical style, when economy is not considered when a ship is in danger or an iron-clad in action.

The size of valve is reduced, hence a reduction of the pressure on the valve face. The travel is less, hence less wear and tear and less force required to move the valve the shorter distance.

The gear will give a greater port opening than a double-ported valve with the same travel and cut off.

The gear receives all its motion from the wiper shaft; therefore the eccentric is not bound to any special position on the shaft. The eccentric is small or may be any convenient size. As they are connected to a wiper, a very small eccentric may be used for an early cut off.

The gear is designed for marine engines; the reversing eccentric is not shown. For simplicity of illustration any ordinary existing reversing motion may be retained.—D. A. M.

SLIDE VALVE GEARS.

To the Editor of THE MARINE ENGINEER.

DEAR SIR,—Kindly permit me to add to my letter of the 9th ultimo a few brief remarks on points raised by the discussion on Mr. Milton's paper, published in your recent number.

Mr. D. B. Morison's objection to my claims is not supported by facts. There exist no publications or impediments which affect the validity of my patent in question, and which undoubtedly covers the gear described as Mr. Wyllie's valve-gear in THE MARINE ENGINEER of November, 1885. (The German patent was granted.)

As the laws of this country give me the benefit (and I think fairly and justly so) I do not, as implied, disregard the homage due to Mr. Hackworth and others by attaching my name to this gear.

The practically perfect valve motion for marine engines produced by this gear is due to the increased load on the radius rod (pendulum link), which according to Mr. Milton's comparison is more than twice as great as that in the other form of gear. To obtain the same result by the latter its eccentric throw must be made more than twice as great as that of my gear.

The difficulties which Mr. Milton seems to apprehend from this increased load disappear in practice, as is evinced by the facts that over 300,000 I.H.P., including some American locomotives and engines of the Russian Navy, are fitted with my gear, and that buyers who have tried it invariably specify it in their next orders.

I hold that Mr. J. Weir does not make out a good case. Multiplicity of working parts must always remain an offence against sound engineering practice. If a secured invention is worth anything, it will cover a fair royalty, and no intelligent manufacturer will be induced by the mere absence of a royalty charge to adopt permanently an obsolete invention.

In some cases it is deemed of importance to have the crank-shaft free from eccentrics and to actuate the valves from the connecting rod.

I believe that my latest invention, No. 7,886, 1886, meets this want most efficiently, and hope to give a full description in your esteemed paper at an early date.

Yours faithfully,

September 6th. GUSTAV A. C. BREMME.

LIFE BOATS.

To the Editor of THE MARINE ENGINEER.

SIR,—I am glad you have opened your journal for a discussion on this subject. Practically we have no life boats on our coasts; about twenty boats on the Norfolk and Suffolk coasts may be termed such, and a few odd ones elsewhere, generally belonging to private persons, and which are considerably snubbed by an organisation which has got a monopoly, which supplies boats only fit to please benevolent old ladies ignorant of such things. Steam life boats are also tabooed or made a pretence of by playing with an old form of propulsion which failed even with steam launches. In my next, if you insert this, I will forward you a large collection of the opinions of experts on our present life boats, and which I will also send gratuitously to any of your readers taking an interest in protecting our brave men who have perilous work to preform or in saving life from loss by shipwrecks.

Yours, &c.,
F. JOHNSON,
Hon. Sec. to Committee of Independent Enquiry into our Life Boat Service.

Alexandra Palace,
Sept. 1st, 1888.

ROYAL NAVAL RESERVE.

To the Editor of THE MARINE ENGINEER.

SIR,—In your issue of April, in an editorial on a paper by Lieut. W. C. Crutchley, of the Royal Naval Reserve, reference is made to the very small number (three men) of marine engineers in the Naval Reserve. Permit me to make a few remarks, in which I wish to show the reason I did not join, and which to substantially the same as that of all the engineers I have spoken to on the subject. Engineers are, as a class, fairly educated, have served a long apprenticeship in the shops, and are therefore men before going to sea. In the shops they are on equal terms with all about them, excepting, of course, the foremen, who treat all with uniform courtesy. An engineer finds on going to sea that it is not only his chief to whom he is subservient, but all the deck officers consider themselves his superiors and act accordingly. This is very galling, especially as they are frequently people of little education, who have been tyrannized over in their youth until they become officers themselves and in their turn tyrannize over others. Now, an engineer will not voluntarily put himself under this humiliation; he only submits to it in order to make a living, and therefore will not join the Naval Reserve, where he believes from the same class of people he must put up with countless snubs.

I am quite sure that there is no class of men more loyal than mercantile marine engineers, and when they are really wanted there will be no lack of volunteers.

I am, Sir,
Yours, &c.,
J. C.,
Marine Engineer

September 12th, 1888.

Reviews.

Turning Lathes: a Manual for Technical Schools and Apprentices. Edited by James Lukin, B.A. London: E. & F. W. Spon.

WE have recently been favoured by the Britannia Company, of Colchester, with a copy of the above work on turning, which is edited under their direction so as to enable them to supply the demand they have found to exist for an explicit and reliable lathe instructor at a moderate price.

That the book is the work of a thoroughly practical hand, one who understands lathes and how to use them all round to the best advantage, is evident on the face of it; nor can we call to mind any book (of instruction) which contains so much solid information in so little space. As its full title implies, the book has been written more especially for those who may be expected to know little or nothing about lathes, but who are assumed to have some knowledge of and natural aptitude for the use of tools, and to such a class the book will prove invaluable; and, indeed, we question if any turner, however skilful or long his service as such may have been, could go carefully through this unassuming little manual without picking up a "wrinkle" or two here and there, that would be well worth his knowing. Throughout the work is written to teach the reader how to do things for himself without hampering his individuality, rather than to advance any pet theories as to how this and that might be done, the aim of the instructions and directions being to give the "reasons why," and thus teach the "principles" in simple language.

The book contains some 160 pages, and is illustrated by nearly 200 figures of lathes, tools, fittings, and diagrams of methods of doing work, how to grind tools, &c.

The chapter on "Choosing a Lathe" ought certainly to be read by everyone, amateur or otherwise, before purchasing one of these delightful tools; while to those lucky enough to be the possessors of a good lathe, the chapters on screw-cutting, metal-spinning, ornamental turning, milling or planing in the ordinary lathe will, each and all, prove both interesting and instructive reading; as will also the directions how to turn a three or four square article in a lathe by a simple contrivance, which any amateur could make at a trifling expense from the drawings given, and so add greatly to his lathe's capacity for work. The price of the book (3s.) places it within the reach of all, and in conclusion we can only say that, as a manual from which his sole instruction in turning had to be gleaned, we should not hesitate, but would rather rejoice, to place it in the hand of any student or workman who might be desirous of *thoroughly* grounding himself in the art of turning.

Iron and Steel Founding. By Claude Wylie. Sunderland: Thomas Reed & Co.

THE author, a practical iron and steel moulder, has produced a book which cannot fail to be of considerable value to all interested in the manufacture and use of iron and steel, while for the amateur the book is just the thing, as it tells him all about iron and steel founding in simple and straightforward language, and shows what to do and how to do it in a practical and efficient manner.

That a want of such a book existed is evinced from the appearance of this, a second edition, and in it the author has seized the opportunity to make many additions to the part on iron founding. Many illustrations have also been inserted, and these additions have been still further supplemented by a practical treatise on steel-founding. The latter subject is entirely new to the public, having never yet, we believe, been attempted by any practical person, and its inclusion in this addition adds greatly to the value of the book.

In a short opening chapter Mr. Wylie traces what may be termed the rise and progress of "castings in primitive times," while in his final "remarks" he shows how he has endeavoured to raise the moulder's art until "we shall have a science instead of a craft, and knowledge instead of habit or mechanical skill, with more intelligence, and engineering as a whole will be all the more benefited thereby in the advancement of one of its most important, but neglected, branches."

In conclusion, we can only say that a careful perusal of Mr. Wylie's most instructive book will go far towards placing those who may be desirous of doing so in a better position than they were in before reading it, to help forward the advancement of the moulder's interesting, but too often neglected, art.

The book is convenient in size, printed on stout paper in good bold type, and the 39 diagrams with which it is illustrated show themselves to be the handy work of the workman, rather than the finished productions of the accomplished draughtsman.

The Mechanic's Workshop Handybook. By Paul U. Hasluck. London: Crosby Lockwood & Son.

IN his latest venture as an author Mr. Hasluck has succeeded in producing a handy little volume, out of which it is possible to cull a large amount of most useful and interesting information, be the reader the veriest amateur or the most experienced worker. As its title implies, the book is designed for the help and guidance of young mechanics and others interested in the manipulation of metals, and it therefore commences with some account of the constituents and characteristics of the metals and alloys familiar to the mechanic in his daily work. After giving this information in a clear and succinct manner, the book proceeds to give practical teaching and counsel on various processes and operations which go to make up the occupation of workers in metal, while special attention is given to the handling and treatment of various tools. Being an outcome of practical experience, the book cannot fail to be useful to the young aspirant who aims at an intelligent appreciation of the "why" and the "wherefore" of the work he has to do. The book is fully indexed, so rendering it useful for ready reference, and, judging by the length to which this index runs, there does not appear to be much omitted that comes within the scope of the book.

The Technical Education of Engineers: a course of study recommended by the Manchester Association of Engineers. Manchester: The Secretary of the Association.

We have recently received from the Secretary of the Manchester Association of Engineers a most useful and interesting pamphlet on the subject of technical education for engineers. The pamphlet is designed for the purpose of guiding youths engaged in engineering workshops in their study of the different branches of science specially bearing upon their occupations, and to indicate to some extent which, having regard to their future careers, are the more important branches, and which can with advantage be studied first.

The various notes deal clearly and concisely with the different subjects which go to make up the course of reading recommended to different pupils, while the syllabus throughout is based upon that of the Science and Art Department, the classes in connection with which may now be found in nearly all towns, and of comparatively easy access by every pupil.

The thoroughly useful and practical nature of the pamphlet is testified to by the fact of its having been produced under the direction of men (*i.e.*, the Association) who have, figuratively speaking, "gone through the mill" themselves, and are therefore best qualified to point out to others the best course to follow. Any youth who goes carefully through the pamphlet and follows carefully the line of action laid down for him will only have himself to blame if he does not benefit greatly by doing so.

We cordially endorse the earnest desire of the Association that every youth engaged in the various engineering and mechanical trades should have a copy placed in his hands, and the very modest price (2d.) of the publication renders this easy of attainment.

Miscellaneous.

Revival of Shipbuilding Industry at Alloa.—The shipbuilding industry, which has of late years almost died out in Alloa, on the Forth, is about to be revived, the well-known shipyard at that port having recently been leased by the Grangemouth Dockyard Company. It is intended to use the yard for the building of the hulls of vessels, which will subsequently be supplied with their engines and fitted out for sea on the other side of the Forth at Grangemouth. Repairs and alterations have already been commenced at the Alloa shipyard. It is gratifying to know that the Dockyard Company are so hopeful of the condition of the shipbuilding industry in the early future. Since they took possession of the dockyard they have passed a large amount of excellent work through their hands. It is anticipated that the keel of the first vessel in the Alloa shipyard will be laid down within the next two or three weeks.

Shipbuilding at Bilbao.—The Board of Admiralty having accepted the tenders of Palmer's Shipbuilding Company and Martinez Rivas, of Bilbao, for three large cruisers, to be built in yards which these firms will immediately establish on the banks of the Bilbao river, considerable agitation has arisen in Cadiz and Ferrol, whence rival native firms had also sent tenders. Influential deputations from both places have come to Madrid to ask the Government to reconsider the decision of the Admiralty, but the majority of the Cabinet, including the Minister of Marine, are of opinion that the Government could select no more advantageous site for the creation of yards than at Bilbao, the inhabitants of which are preparing festivities in order to show their satisfaction, directly the *Gazette* publishes the decree confirming the award of the admiralty. Indeed, when the works outside the mouth of the river and the new yards are completed, Bilbao will be the first port in the Peninsula. Even outside its importance is steadily increasing. The iron ore trade is also chiefly in British hands.—*Standard.*

A Naval Invention.—The *Itzehoer Nachrichten* states that at the last naval manœuvres before Kiel an application of a swimming dress was made which has been tried till now only in the German navy. The dress is like a diver's dress, made of indiarubber, and double. On the chest is a valve through which air is blown into the interior of the dress, which covers the whole body and leaves only the face bare. To prevent the swimmer from being too much tossed about by the sea the space round the chest is well filled with air. About the hips the swimmer wears a girdle, which divides the dress into two parts, to prevent a too great loss of air if the dress were torn about the legs, and consequent difficulty in swimming. The swimmer wears shoes with leaden soles to secure his equilibrium, and for his defence a long knife which is fastened to the girdle. The swimmers are employed for the blowing up of mines and hostile craft, and are provided with an explosive box, which they have to fasten to the mine or craft and to set on fire. Before the explosion ensues they are out of the reach of danger. During the attack on the harbour of Kiel on the 29th of August swimmers were dispatched from the armour-clad squadron to destroy the mines.

Admiralty Contracts.—The Admiralty have contracted with the Palmer Shipbuilding Society to supply and fit the machinery of the new steel cruiser *Barracouta*, which is ordered to be built at Sheerness yard. The *Barracouta*, the first of a new type of fast cruisers, has been designed for the Royal Navy by Mr. W. H. White, Director of Naval Construction, and is to be fitted with machinery of 3,000 H.P., estimated to propel her at a speed of 16·5 knots per hour. The *Barracouta* will be 233 feet in length over all, with a breadth of 35 feet, and a displacement of 1,580 tons. Her armament will consist entirely of quick-firing guns, instead of breechloaders, with which the cruisers of the Navy are at present armed. She is to carry six 36-pounder quick-firing guns, two of which will be mounted on sponson ports forward, two aft, and two amidships. On the main deck she will carry four 3-pounder quick-firing guns, two of which will be mounted under the poop, and two under the forecastle. She is also to be fitted with four tubes for discharging Whitehead torpedoes. Four cruisers of the *Barracouta* class are to be built for the Royal Navy during the present financial year, and these vessels will be a great improvement in every respect upon the sloops of the *Osprey* and *Kingfisher* class, which they are destined to replace.

The Japanese Navy.—The Japanese Government has ordered from France the material required for two steel war steamers to be built in the Yokosuka yard.

The Russian Marine in the Caspian.—The *Moscow Gazette* states that the Russian marine in the Caspian is rapidly increasing. It now numbers 70 steamers, besides many sailing vessels. Ten new iron steamboats have been finished in the present year, and one firm of Nijni Novgorod proposes to establish a dockyard on the coast of this sea.

The Strike in Belfast.—The strike in the Belfast shipbuilding trade ended on Wednesday evening, September 19th, arrangements being made for the opening of Messrs. Harland & Wolff's works at the usual hour on Thursday morning. The terms of settlement are these:—The employers grant an advance of 1s. 6d. per week to riveters throughout the works and to platers employed in the shipyard, and 1s. per week to platers working in the boilermakers' shop. The men, on their part, concede piecework prices to the firm at the same rates as are paid in other parts and in the yards in Belfast. This undertaking by the men will considerably facilitate the execution of work in the yard.

Trades Exhibition at Cardiff.—A large Exhibition, promoted by the National Trades Exhibition Association, was opened at Cardiff on September 12th. The Mayor and Corporation, accompanied by the local members of Parliament and many influential residents of South Wales, walked in procession from the Town Hall to the Exhibition grounds, where the Mayor was presented with a silver key, with which the doors were unlocked. Among those who accompanied the procession were the Bishop of Llandaff, Sir Hussey Vivian, M.P., and Mr. A. J. Williams, M.P. The Exhibition, which covers a great area of ground, and includes contributions from some of the largest manufacturers in the United Kingdom, will remain open for two months.

Re-opening of a Govan Shipbuilding Yard.—The Govan Shipbuilding Yard, commonly called "Dobie's Yard," which has been closed for a considerable time, is now undergoing repairs previous to its re-opening by a new firm. The active and managing partner in the new concern is Mr. William Arbuckle Mackie, who has for many years occupied the position of chief draughtsman to Messrs. Alexander Stephen & Sons, Linthouse Shipbuilding Yard, Govan, and the partner representing the financial and commercial departments is a gentleman of large business experience commanding the necessary capital for the carrying on of so important an industry. The new firm is expected to be ready and in full swing in the course of a few weeks.

NEW TORPEDO GUN VESSELS.—The Admiralty have issued instructions for the new first-class torpedo gun vessels which are to be built at Sheerness Dockyard to be named the *Gossamer* and *Gleaner*. They are to be taken in hand at an early date, and are to have a displacement of 735 tons, and a length of 230 ft. They are to be built of steel from the designs of Mr. W. H. White, Director of Naval Construction, and will be equipped with an armament of quick-firing guns and torpedoes. The machinery of the *Gossamer* and *Gleaner* is to be of the triple-expansion type, and is estimated to develop 4,500 H.P., with a speed of 21 knots. The machinery of the vessels is to be made at Sheerness Dockyard instead of by contract.

NEW ZEALAND COAL.—Negotiations have been completed by which a syndicate representing English and Colonial capital has purchased an extensive area of about 4,500 acres of land at Ngakawan, about 18 miles north of Westport, with the view of working the coal measures which exist upon the property. A short time since, Dr. Robertson, a gentleman who occupies the position of consulting engineer to some of the largest coal companies in New South Wales, visited New Zealand, on behalf of the syndicate just mentioned, with the view of making an inspection of the area proposed to be purchased. Dr. Robertson's opinion of the country being favourable, terms were proposed to the holders of the area, and the purchase has just been completed.

PATENTS IN DENMARK.—As there appears to exist a certain amount of misconception with reference to Danish patents, the following information (for which we are indebted to Mr. Viggo C. Eberth, of the International Patent Bureau, Copenhagen) will no doubt be of interest and value to inventors and patentees. It is now frequently the case that Denmark is left out even when an invention is patented to a considerable extent. The reasons for this omission are probably, in some instances, a belief that it may perhaps not be worth while going to the expense of a Danish patent, but more often the weightier one, that the short term of a Danish patent may prejudice others admittedly more valuable. Neither of these objections is, however, in accordance with the actual state of affairs. In the first instance Denmark, although a small country, can boast a considerable all-round consumption, as well as very fair means of purchasing. Its industries are, generally speaking, prosperous and increasing, and it is only natural that manufacturers, in Denmark as elsewhere, on account of growing competition, are desirous of getting hold of patented specialities, which they can have for themselves. In reality there are also in Denmark many patents which, worked under a royalty, give the patentees exceedingly handsome yearly profits, while a number of others have been sold for large sums. Of course there are inventions which it would be unnecessary to patent in Denmark, such for instance that apply to mining, &c., but otherwise practical and sound inventions are likely to answer. With regard to the second point, the original term for which a Danish patent is now granted is occasionally increased to ten years, and prolongation of Danish patents is generally granted up to a total term of fifteen years. The duration of the American patent need, however, in no manner be influenced by the term of the Danish, as the issue of the latter can be left in abeyance pending the issue of the former. In order to obtain this delay it is requisite to forward a request simultaneous with the filing of the application for the patent, asking for delay of issue, although the patent may be granted, and in this manner the Danish patent can be kept pending until the American one is issued. Denmark will in all probability get a new patent law in the course of another year or two, and the term of a patent will no doubt be fixed at fifteen years. When the new law has come into operation, older inventions will most likely only be considered patentable if applications have already been filed under the old law, and this is an additional reason for not omitting to do so, although the present law cannot be considered satisfactory. In Sweden and Norway, too, inventors often neglect to protect their interests, although good and suitable patents are likely to prove of value in both these countries.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from August 13th to September 16th, 1888.

11856 W. Farquharson. Range-finder.
11864 R. & W. Marchant. Engine Lubricators.
11865 R. Bradshaw. Canal and other locks.
11910 J. Vavassour. Ammunition hoists for ordnance.
11911 H. H. Grenfell & C. A. McEvoy. Directing discharge of ordnance.
11913 F. R. Lucas. Raising submarine cables.
11920 Lake (H. D. Haverkamp). Utilizing steam as motive power.
11943 Dutton (The American Engine Company). Steam engines.
11958 H. Gourlay. Steam boilers.
11966 W. Horseman & J. Perry. Swinging davits and winch mechanism.
11982 J. B. Whitgreave. Torpedo boats, launches, &c.
11983 J. A. Eno. Steam boiler.
12003 Andrews (E. L. Kitchingman). Build and structure of ships.
12016 H. Gourlay. Stuffing boxes and packing.
12020 J. F. O. Larsen. Oil-holder and distributor for marine purposes.
12026 J. R. Hargen. Life-saving raft.
12027 C. C. Longridge. Centre board for yachts, &c.
12029 J. Turnbull, jun. Piston-packing ring.
12034 J. Broome, jun., & J. C. Broome. Rowing boat seats.
12051 V. Baron & J. Demode. Saving or rescuing papers, &c., in case of shipwreck.
12060 G. Dürr. Steam-generators.
12072 A. P. Howes. Valve cocks.
12075 J. W. von Pittler. Steam-generators.
12076 J. & J. R. Richardson. Steam engines.
12083 Comte A. V. de Vismes. Screw propellers.
12090 A. Taylor. Signalling at sea.
12104 R. W. Mewes. Valves for reversing engines.
12113 G. B. Satterlee. Quick-firing guns.
12119 A. H. Broadbent. Directing and firing naval ordnance.
12124 Batley (A. Vermersch). Oscillating pumps.
12125 Ditto ditto Lubricating apparatus.
12136 J. Farcot. Steam and other motors.
12146 G. M. Marchant. Light feed lubricator.
12151 L. Langlois. Increasing speed of steam engines.
12160 W. Holder. Ships' propellers.
12166 Edwards (F. Le Moal). Steam boilers.
12187 A. Pietsch. Valve motion for marine engines.
12194 T. Stanley. Self-acting motor for vessels, &c.
12204 J. C. Dodd. Sea floating bathing-machine.
12211 G. Rockliffe & W. Key. Slipping device for ships' boats.
12214 W. G. Akhurst. Removing scale from boilers.
12224 W. S. Simpson. Ordnance, &c.
2226 C. L. Reade. Reversing steam engine.
12232 Lake (G. P. Erhard). Steam-generators.
12233 M. A. Howell, jun. Armour plates.
12338 R. Werner. Propelling boats.
12242 W. P. Granville. Measuring speed of ships.
12267 C. Henderson. Collapsible boats.
12280 J. S. Raworth. Engine governor.
12288 R. H. Fowler & G. Achilles. Steam engines.
12291 J. Vavasseur. Gun mounting.
12294 W. Gould. Pumps.
12312 G. A. Winder. Rotary pumps.
12317 Flürscheim & Bergmann. Steam boilers and engines.
12331 A. de Dion, T. G. Bouton & G. A. Trépardoux. Tubular steam generators.
12372 J. Robbins & T. Moy. Raising sunken vessels, &c.
12381 Lake (G. L. Kitson, J. Reagan & S. L. Smalls). Fire grates of boiler furnaces and feed-water heater.
12441 J. Lea. Making steam boilers, &c.
12449 J. G. W. Aldridge. Berths and seats for ships, &c.
12468 T. Eccles. Preventing damage to ships.
12475 J. Harper. Screw propellers.
12476 J. Turnbull, jun. Multiple expansion steam engines.
12500 J. Russell & Co., Limited, and A. W. Hutton. Steam boiler tubes.
12517 E. W. Jones & H. Cutting. Boiler-feeding apparatus.
12545 J. Mills. Water-tube steam boilers.
12553 J. Stenard, jun. Propulsion of ships.

12561 T. J. Gibson. Valve link motion of steam engines.
12562 Ditto ditto
12579 J. T. Halsey. Valves and valve gear for steam engines.
12585 R. W. Hewett. War ships and batteries.
12599 J. Page. Steam jet pumps.
12605 R. Chambers & G. Cowper. Lifeboat.
12631 F. Hime. Propelling ships, &c.
12657 J. A. Rowe. Controlling engines.
12669 F. J. Baker. Controlling gun recoil.
12671 E. A. & H. Sandford. Valves and seatings.
12677 J. B. Smith. Valves.
12694 H. Hammond. Mariner's compasses.
12697 G. Trench. Signals for use at sea.
12700 H. S. Sitwell. Gun-carriage.
12710 A. Vogt. Furnace bars.
12714 T. Ide. Propelling ships.
12730 C. Forrest & C. Myers. Screw propeller.
12738 W. Hartcliffe & W. H. Malkin. Steam traps.
12740 Fairweather (H. C. Spohr). Indicating variations of water level in rivers, &c.
12743 T. Downie. Piston packing.
12765 W. Dargue. Piston packing.
12769 A. M. W. Samson. Ships.
12777 T. Nordenfelt. Working ordnance.
12791 T. Mudd. Indicating power developed in steam engines.
12792 Ditto Quadruple expansion engines.
12799 H. J. Wells. Pumps.
12800 G. F. Nilsson. Steam boilers.
12810 J. M. Fletcher. Guns.
12827 A. Andrews. Protecting ships' tanks, &c.
12859 T. Hunt. Steam-generators and furnaces.
12867 A. Butterworth. Taps and valves.
12869 A. H. Stott. Feeding fuel to boiler furnaces.
12876 G. M. Marchant. Lubricators.
12885 R. J. Meek & J. Rivolta. Paddles, screws, &c.
12925 G. Vaughan. Ships' cables.
12930 J. O. Holt. Ships' berths, &c.
12933 R. M. Simpson. Rotary pumps.
12939 T. W. Duffy & W. J. Cousins. Boiler furnaces or flues.
12956 T. Mudd. Manholes in steam boilers.
12968 E. G. Hill. Boat-detaching apparatus.
13021 E. L. W. Haskett-Smith. Range-finders.
13039 G. Rose. Steam generators.
13077 Imray (W. Lorenz). Breech-loading apparatus for guns.
13090 H. G. Small. Engine packing.
13098 W. Allen. Steam regulating valve.
13117 J. Kleinpeter. Armour plates.
13141 C. E. Hudson. Heating feed water of steam boilers.
13142 Wise (E. R. von Skoda). Quick-firing guns.
13148 H. Osborne. Propelling ships, &c.
13176 J. Coulson. Ships' log.
13186 A. McGlashan. Engine valve.
13199 J. Hopwood. Steam valves, &c.
13200 S. H. Sturtevant. Guards for water gauges.
13202 F. Thomas. Lowering ships' boats.
13231 L. Roovers. Pumps.
13238 A. Thomson. Mechanical stokers.
13241 A. E. Penn & B. Riches. Propulsion of boats, &c.
13255 T. Lishmann. Steam generators.
13265 T. Northey. Low-water alarm for steam boilers.

BOARD OF TRADE EXAMINATIONS.

Note.—1 C, denotes First Class; 2 C, Second Class.

July 21st, 1888.

Ambrose, Wm... 2C Liverpool
Ellis, John Alf. 2C ,,
Ellis, John S. .. 1C ,,
Fazackerley, R. 2C ,,
Forsyth, Geo. .. 2C Leith
McCutcheon, H. 2C Liverpool
Morrison, John.. 2C ,,
Pascoe, Alex. J. 2C ,,
Renfrew, John.. 2C Greenock
Richardson, K... 2C Liverpool
Stanley, W. H. 1C ,,
Thornton, T. R. 1C London
Walker, C. G. .. 2C ,,
Wooton, E. G. 2C London
Wright, Francis 2C Liverpool

August 4th, 1888.

Abbot, David .. 2C Cardiff
Bruce, Robt. G. 1C Glasgow
Candiliotis, M.... 2C Cardiff
Fairlie, T. F. .. 2C London
Foord, J. C. .... 2C ,,
Gallacher, Jas... 1C Glasgow
Gourlay, J. .... 1C ,,
Henry, W. P. .. 2C N.Shields
Johnson, Geo... 2C Cardiff
Leask, Robt..... 2C N.Shields
Lister, A..... 1C Cardiff
Mackie, Jas..... 1C Glasgow
Manderson, C... 1C Cardiff
McCallum, J. A. 1C ,,
McFarlane, J. G. 2C Glasgow
Morgan, Wm... 1C Cardiff
Parfitt, A. E. .. 2C ,,
Phillips, M. .... 2C ,,
Richmond, G. J. 2C London
Rundle, H. P. .. 2C Cardiff
Rutherford, R... 2C Glasgow
Sampson, H..... 1C Liverpool
Speedy, J. C. .. 2C N.Shields
Spencer, G. L... 2C Cardiff
Stephens, M. .. 2C ,,
Tate, E. C. .... 1C London
Thomas, Jas. .. 1C Cardiff
Thompson, John 1C Glasgow
Watson, R. .... 1C ,,
Williams, E..... 2C Cardiff
Williams, Thos.. 2C ,,

August 25th, 1888.

Banfield, E. W.. 2C S'th'pton
Barrow, Alfred.. 2C Liverpool
Baxter, Robert 2C Glasgow
Bird, Alfred H. 1C ,,
Blackstock, D. 2C London
Blundell, Edwd. 1C Liverpool
Bowie, Robert.. 1C Glasgow
Brinton, Jos. F. 1C N.Shields
Cooper, Alex. .. 1C Aberdeen
Croft, John .... 1C Glasgow
Davis, Ogley .. 2C Cardiff
Evans, John N. 1C ,,
Fraser, John.... 1C N.Shields
Gardner, John J. 1C Dundee
Gardner, W. M. 2C N.Shields
Goddyn, A. G... 2C London
Goodfellow, A... 2C Glasgow
Hill, Wm. .... 1C ,,
Hosgood, T. W. 2C Cardiff
Hunter, David.. 1C Glasgow
Inman, G. M. S. 2C Liverpool
Jeffery, Wm.... 2C London
Jobson, Alex. .. 2C N.Shields
Kelly, E. J. .... 2C Cardiff
Ladmore J. E... 2C S'th'pton
Lamb, Wm. .... 2C ,,
Lane, John .... 2C ,,
Lewis, Wm..... 2C N.Shields
Menzies, Jas. .. 1C Dundee
O'Brien, John .. 1C London
Ould, John Geo. 1C ,,
Payne, H. F.... 1C Glasgow
Phoenix, Edwd. 2C London
Post, G. W..... 2C S'th'pton
Runcie, J. E. .. 2C London
Russell, John .. 2C Glasgow
Smith, A. L. .. 2C S'th'pton
Smith, Thomas.. 1C Cardiff
Steele, A. C..... 1C Glasgow
Stewart, John .. 1C Aberdeen
Stewart, Peter .. 2C Glasgow
Stewart, Wm. .. 1C Liverpool
St. John, E. F.. 2C Plymouth
Topley, Joseph 2C Liverpool
Williams, David 2C Cardiff
Williams, W. H. 2C Liverpool

September 1st, 1888.

Aird, Henry.... 2C N.Shields
Arnison, Hugall 2C ,,
Ballinger, C. .. 2C Cardiff
Band, James.... 1C N.Shields
Cassap, John H. 2C London
Crosby, John .. 1C N.Shields
Davies, T. J. .. 2C Cardiff
Gaven, F. W... 1C Liverpool
Gill, J. S..... 2C N.Shields
Hales, E. J..... 2C Liverpool
Haughton, H. B. 2C ,,
Innes, A. ..... 2C Liverpool
Jolly, G. H..... 2C ,,
Ligertwood, T. 1C London
Lynn, M. W. .. 2C N.Shields
McCall, R. .... 2C ,,
Nutt, C. R. .... 2C London
Pritchard, J. E. 2C Liverpool
Simpson, L..... 1C Hull
Step, H. F. J... 2C Falmouth
Stewart, J. .... 1C N.Shields
Tindle, W. .... 1C ,,
Williams, T. .. 2C Cardiff

September 8th, 1888.

Anderson, D. H. 2C Glasgow
Auld, Wm. .... 1C ,,
Campbell, John 2C Liverpool
Dixon, H. T. G. 2C Cardiff
Downie, John .. 1C Liverpool
Fletcher, Hugh.. 1C ,,
Florence, James 2C Glasgow
Greenwood, J. H. 2C London
Jamieson, C. F. 2C Glasgow
Keith, Hugh .. 1C Liverpool
Kelly, Robert .. 1C Greenock
Lindsay, John C. 1C N.Shields
Macfarlane, R... 2C Glasgow
Mathieson, D. .. 1C Greenock
McAusland, John 1C Glasgow
McMenemey, J. 2C Liverpool
Miller, Donald.. 1C Glasgow
Nicol, Archibald 2C ,,
Orton, T. A..... 2C Liverpool
Palmer, Thomas 1C Greenock
Peacock, John O. 1C N.Shields
Reid, John .... 2C Liverpool
Robertson, Jas.. 2C Glasgow
Ross, Henry W. 1C Liverpool
Shanks, Mathew 1C Glasgow
Snowden, Thos. 2C Liverpool
Stalker, A. S. .. 1C Glasgow
Towers, Wm. .. 1C London
Webb, O. G. .. 2C Liverpool
Wimshurst, J. E. 2C London
Young, James .. 1C Glasgow

September 15th, 1888.

Albinson, J. E. 2C W.H'pool
Atkin, W. R. .. 2C Liverpool
Bailey, Walter.. 1C W.H'pool
Bradley, J. K... 1C Leith
Brown, Jas..... 2C Dundee
Cattrall, G. L... 2C Liverpool
Dalrymple, Saml. 1C Leith
Davis, Thos. .. 2C W.H'pool
Deighton, Thos. 1C ,,
Fairweather, J.W. 1C Leith
Greig, D. D. .. 1C W.H'pool
Hewitt, W. R... 1C Leith
Husband, W. H. 2C W.H'pool
Johnstone, J. .. 1C Leith
King, Wm. .... 1C W.H'pool
MacLeod, D. .. 2C London
McLeone, H. A. 1C Liverpool
McPherson, A... 1C Leith
Mead, M. R. .. 2C W.H'pool
Moon, Wm. G.. 1C Leith
Morton, James.. 2C Liverpool
Munro, J. R. .. 2C Dundee
Myers, J. R. .. 1C London
Potts, E. C. .... 2C N.Shields
Quy, Geo. H. .. 1C London
Rusden, Saml. L. 2C Plymouth
Smith, Robt. P. 1C Liverpool
Stenhouse, J. .. 2C Leith
Taylorson, R. J. 1C W.H'pool
Todd, Robert .. 1C Leith
Turner, James.. 1C N.Shields
Urquhart, A. .. 2C Leith
Wilkinson, J. R. 2C W.H'pool
Wright, Ed. R. 2C N.Shields

The Marine Engineer.

LONDON, NOVEMBER 1, 1888.

THE question of the hour at Preston is, "Will Parliament during the ensuing session grant additional borrowing powers to the Corporation to enable them to complete the scheme for improving the navigation of the Ribble and the construction of a forty-acre dock?" We are not in a position to pronounce an opinion as to whether Parliament will or will not accede to the request, but the recent decision of the Town Council of Preston will undoubtedly be contested to the bitter end by the coterie known as the "party of caution." A fund of information and instruction can be extracted from the history of this costly project from its very commencement, which may here be briefly recorded for the future guidance of other inland towns whose manufacturers are reported to be seriously contemplating similar propositions to enable them to transfer their goods *viâ* canals to the sea, instead of by rail. The works were originally estimated to cost about £600,000; but shortly after the Corporation obtained the necessary powers from Parliament, in 1883, the promoters extended their operations quite beyond their legitimate functions. There was no mention of a tidal basin in the estimate, but it was decided to make one at a cost of £35,000. The river-diversion was to cost £86,000, whereas £94,000 was spent in consequence of alterations in the original plans, while the estimate generally was exceeded to the amount of £112,000. This is not all. The members comprising the august body immediately commenced to build the dock for the accommodation of the latest type of vessels before they were perfectly certain they could make a safe, deep, and permanent artificial waterway, from the sea to the dock, through a sandbank extending some five miles wide and about eight miles long, irrespective of the remainder of the channel. Evidently these gentlemen never read, or, if so, had forgotten, the predicament experienced by Defoe's exile, Robinson Crusoe, who, having built a boat after enormous labour, was puzzled how to get her to the water. These peculiar tactics of the Corporation, however, did not provoke notice in Preston, except from a few 'cute observers, until about this time last year, when the Corporation announced that they intended to apply to Westminster for additional borrowing powers to the amount of £510,000. Public meetings of ratepayers then became as plentiful as mushrooms in season, and an association was formed by the "party of caution" to protest against the passing of the Bill. The Corporation, however, decided to apply to Parliament for the amount specified, but promised that an independent river and dock engineer should be called in to pronounce an opinion as to whether this proposed second instalment would secure a practical navigable channel from the bar to the dock-sill. In May last, the Select Committee of the House of Lords practically sympathized with the "party of caution" in their feeling of uneasiness, for in granting the promoters just sufficient money—£240,000 instead of £510,000—to allow them to meet pressing wants, they intimated that the policy pursued was quite unprecedented. The Committee advised the Corporation to apply next session; in the meanwhile to arrive at an amicable settlement with the "party of caution," and prepare a final and complete scheme. The Committee further remarked, alluding to the then-pending report from Mr. Abernethy, that they should attach great value to his engineering evidence, and be largely guided by his advice. The eminent expert's pronouncement appeared in June last, and caused another sensation. Mr. Abernethy severely criticised many features of this mismanaged undertaking, and suggested the entire abandonment of the Gut Channel and advised the substitution of the north course. The latter, he remarked, is land-locked nearly throughout its whole length to the northward, and consequently protected from the range of the sea on that side by a hard permanent foreshore, while on the south shore the sea has comparatively little effect, owing to its force being greatly diminished by the large expanse of Salthouse Bank, in parts 18 ft. above the level of low water, over which it has to pass before reaching the channel. The estimated cost of making this waterway is considerably less than that upon which so much has already been expended. Referring to the successful results attending the construction of training walls and dredging in the Tyne, Clyde, and Tees, Mr. Abernethy explained that these operations occupied an exceedingly long period, and involved expenditure greatly in excess of any estimate yet submitted in connection with the Ribble. Evidently, from this, "some one has blundered" over this scheme. The estimate of 1883 was supposed to be sufficient; now it is predicted that two millions will not suffice! Cheering news for Preston! In making an analogy between the before-mentioned rivers and the Ribble, the report mentioned that these improvements were to a considerable extent antecedent to the construction of docks, and that the present place differed in one very important feature from the rivers named, in having extensive sandbanks stretching several miles seaward. Mr. Abernethy's

report was duly placed before the Council, and by them referred to a mixed tribunal, composed of members of the Ribble Committee and the "party of caution," who more easily swallowed the uncoated pill, compounded by the expert, than did the Council, for the tribunal decided by vote to recommend its adoption. At a special meeting of the Preston Town Council, held a few days ago, however, Mr. Abernethy's plans were, metaphorically speaking, thrown overboard, and a resolution passed to again ask Parliament for the necessary powers to conclude their present scheme. Faith, we are told, will remove mountains: the Preston Corporation evidently possess an abundant supply of this virtue, for they still believe that, after dredging the Gut Channel, the miraculous agencies of the scour will remove, unaided by the arts of modern inventions, the miles of sandbanks beyond Lytham. May their faith be rewarded, if only for the sake of the ratepayers' pockets! The Council not having followed the instructions of the Parliamentary Committee, given in May last, may have their Bill again referred back, in order that Preston may return at a future period with a complete scheme, and with conflicting interests reconciled.

THE prospects of shipowners and their already realised results have very materially altered during the present year. There is now, at any rate, almost a certainty of fairly remunerative freights. Most of the vessels, which have been so long laid by, have at length been taken up, and are fairly occupied. The builders are busy with many orders in hand for forward delivery, and there may be said to be generally from 25 to 30 per cent. of freights all round, many freights being as much as 50 per cent. better than they have been for the last year or two. Such a change must be generally accounted for by statistics of our import and export traffic, and the relative tonnage in existence to carry it. This may be readily seen by examination of those figures to as far back as 1882. In that year as many as 972 vessels were built for the service of the United Kingdom, and in 1883 the number had risen to 1,174; but from that time there has been a marked decrease in the number of vessels and in their tonnage. In 1883 the tonnage of vessels built for home service, as distinct from those built for foreigners, reached 768,576 tons; but this production has rapidly fallen off, until in 1886 only 293,000 tons were built. The cause of this is obvious, as from 1883 to 1886 there has been a small total decrease in the import and export trade. With regard to the tonnage added in 1882 and 1883, the tonnage added covered all losses and left a net addition of over 250,000 tons without a corresponding increase in the import and export trade, which in 1884 and following years did not exist. It was obvious that this balance of increase in the carrying tonnage of the United Kingdom was all to the bad, merely spoiling the market in their effort to obtain freights. This has only produced the effect of an almost total cessation of increase of tonnage beyond losses, until in 1887 there was only an increase upon its predecessor of ½ per cent. Thus at the end of 1886 an equilibrium between the carrying trade and the means for carrying it was reached. In 1887 there was a considerable increase also in the export and import trade, amounting to about 7 per cent. on the total for the previous year. Hence it would necessarily follow an increased demand for shipping, bringing with it in the first instance a rise in freights all round. It would thus seem that did shipowners closely follow the statistics of the export and import trades and refrain from providing an excessive amount of tonnage to carry the actual goods to be transported, they could always maintain fairly remunerative rates. There is no doubt that the increase of our trade by "leaps and bounds" which had taken place in the years prior to 1882 had led shipowners to imagine that the constant increase of trade would be maintained. The chief injury that has arisen from this mistake on the part of shipowners appears to us to have been that this fact was not soon enough recognised and establishments kept on a sufficiently reduced scale until the turn or equilibrium had again been arrived at. The shipowners are again face to face with the problem as to what may be the total increase in imports and exports in the coming year, and what fair increase of carrying tonnage may be added without dangerous excess, such as again to cut down remunerative rates. At present vessels in hand being built are more in number and larger in tonnage than the average, and there is a great preponderance of steamships; so far the trade has taken up all that have been launched without showing weakness in the rates of freight, but the rate of construction at present is so much above the average that it could hardly be absorbed without a considerable permanent increase in freight carried as compared with the last few years.

THE startling and disastrous explosion of the *Ville de Calais*, a tank petroleum vessel, in the harbour at Calais, cannot but pointedly press upon us the question as to how far it is safe for such vessels to discharge their cargoes in the midst of a crowded harbour or in the heart of a city. Tank steamers carrying petroleum larger than

the *Ville de Calais* are constantly coming up the Thames with nearly a million of gallons of oil in their cisterns. Though we have been singularly free during the immense traffic in petroleum that has been rapidly developing during the last few years, it is wise that we should recognise the existence of such a serious risk being constantly with us, if by any means we can thereby, by suitable regulations or precautions, tend to still further minimise the danger. It seems that more than two years ago the Government decided on introducing a Petroleum Storage Bill, in consequence of a serious conflagration at Dudgeon's oil wharf. In the meantime nothing more has been heard about this Bill, and the petroleum trade is quite altered in the way it is carried on. The old method of storage in barrels, both in the hold of the vessel and on the wharf, has been replaced by the more modern system of storage in cisterns, both on the wharves and in the steamers, the transfer being then made conveniently by means of pumps. There is little doubt that the system of carrying the oil in tank steamers and storage by cisterns at the wharves is a safer method than under the old system, in which there was so much leakage from the barrels; but should an accident occur, the disastrous effect of an explosion would probably be intensified. It is already noticeable that the risk does not essentially lie in the chance of the ignition of the oil, but in the ignition of the residual gas either before, during, or after discharge; in fact it may generally be said that a petroleum tank steamer is safer full than when empty. This is obvious, when it is duly noted that it is the gas that is generally the cause of an explosion. This, probably, arises from two causes—first, when the petroleum is actually being discharged and is known to be present, special care is used not to endanger ignition with naked lights, whereas when the cargo has been discharged the danger of the residual gas is as yet much ignored, and entry being then required into the tanks, the risk of the use of naked lights is much increased; second, when the steamer is full there is little space for the storage of the dangerous inflammable gas, and what there may be is probably too concentrated to readily ignite, and it may be well kept under control by proper ventilation. When, however, the cargo has been discharged, and the enormous tanks are left reeking with the oil and residual gases, and when a certain percentage of air has been mixed with it, it is in the most inflammable condition possible whilst apparently innocuous. It is well to remember that refined petroleum oil of itself is so safe that when in its ordinary cool condition lighted matches can be thrown into it with impunity. A gas that will only burn in a concentrated form, such as our common coal gas, only becomes essentially explosive when admixed with a large proportion of air. With proper regulations it would doubtless be easy to guard against the risk of explosion were such regulations enforced. We might suggest that floating the petroleum tanks with water, as an essential regulation, immediately after the petroleum has been discharged, might prove very beneficial as a safeguard against the accumulation of residual gas as the oil is discharged. We have little doubt that should London be startled and horrified by such an explosion as has lately taken place in Calais harbour, safer regulations will be introduced by legislation upon the subject, of which the simplest and most probable form would be a refusal to permit the discharging and storage, on a large scale, of petroleum except at a distance from the metropolis, as it could readily be retailed into the metropolis by pipes in the American fashion. It may be pointed out that the *Ville de Calais* was of French and not of English design, although constructed in this country, and that it was supposed to be specially constructed for the conveyance of crude petroleum, which is much more dangerous than the refined article used in lamps.

At the annual meeting of the Elswick Ordnance Company, Newcastle-on-Tyne, much subject-matter of general interest to the public was dealt with by the president, Lord Armstrong, in his address to the shareholders. First in importance was the description the president gave as to late improvements that they are carrying out in rapid-firing guns up to 6-in. calibre. As a result, it was stated that as evidence of the accuracy of the guns, combined with rapidity of fire, five rounds were fired a few weeks ago at Shoeburyness in which a target only 6 ft. square was hit five times running in 31 seconds at a distance of 1,300 yards. As the penetration of the guns is very great, namely, 10½ in. and 15 in. of wrought iron plate for the 4¾-in. gun and 6-in. gun respectively, estimated on muzzle velocities, these guns become terrible weapons of destruction. As many as ten rounds have been fired from the 4¾-in. gun in 47½ seconds, whereas an ordinary breech-loading gun of the same calibre, firing in competition, took 5 minutes and 7 seconds to fire the same number of rounds. At close quarters a series of such guns firing upon thinly protected portions of an enemy's hull would simply render such a portion of the vessel quite untenable. The advantage gained by the modern rapidity of firing in any gun, as compared with the older-fashioned rate of fire, is equivalent to increasing the number of guns in proportion to the increase of

speed, without the necessity for a proportionate increase of gunners or of armoured area to protect them. It is very probable that the highest possible advantage of such an armament is to be seen in dealing with the attack of torpedo boats at sea. Supposing a torpedo boat to be sighted at a distance of 1,500 yards, it could not be supposed to discharge a torpedo with much certainty at a longer range than 200 yards, and would therefore be under fire for a run of 1,300 yards towards the vessel before she could herself attack. This period of exposure may be estimated, roughly speaking, at two minutes. If the torpedo boat was exposed to the fire of three ordinary service 5-in. guns, they would be able to discharge about 12 shots at the torpedo boat before she came into torpedo range. With the new quick-firing 4¾-in. guns, she would be exposed during the same period to no less than 72 shots, of which any one single hit must prove fatal to the torpedo boat. The next important point in which this enterprising company is opening out further ground is the adoption of a new explosive or powder. The charges can be reduced by about one-third as compared with ordinary powder. The new powder, moreover, leaves no residue in the gun to foul it under quick loading, and the smoke has been so far reduced as to present little obstacle to the sighting of the guns in action. Under the heading also of swift armed cruisers, this firm has acquired a well-deserved reputation, though, unfortunately, most of the finest examples have as yet been built for foreign powers. Amongst these may be mentioned the *Piemonte* for the Italian Government and the *Esmeralda* for the Chilian Government. In the former case the surpassing speed of 21 knots has been obtained with a displacement of only 2,500 tons, and her bunkers are sufficient to enable her to steam 17,000 miles at the most economical speed without re-coaling. Her offensive power is also most prominent. In addition to a complete torpedo equipment and a full complement of Hotchkiss and Nordenfelt guns, she carries an armament of six 6-in. and six 4¾-in. fast-firing guns, as before mentioned. She can discharge in a given time twice the weight of shot and shell that can be fired by the largest war vessel now afloat, and, if not herself destroyed by a chance shot of heavy weight, could rapidly destroy the unarmoured portions of the present leviathan battle-ships. It is much to be regretted that the enormous energy and inventive abilities shown by our private English firms, such as the Elswick Company, is not more monopolised by our Government rather than by foreign governments. Upon the subject of commercial vessels convertible at need into armed cruisers, Lord Armstrong is strongly of opinion that one such specially built vessel as the *Piemonte* would be more than a match for a whole fleet of armed merchantmen, collectively of far greater money value, and that therefore it would be the best economy for the Government, instead of subsidising the present commercial liners, to spend their money in the rapid construction of specially designed cruisers. The enormous increase of destructive power conferred by the adaptation of rapid-firing to guns of comparatively heavy calibre is rapidly making marine warfare of so destructive a character that one must hope such horrors will serve as the best safeguard against maritime warfare being rashly entered upon. The advantage also to shore batteries by being armed with fast-firing guns is so obvious for purposes of defence as to need no further comment on our part.

THE exceptional interest taken in the repeated endeavours of rival shipbuilders to build vessels which will reduce the already short length of time taken to cross the Atlantic shows that the question of speed is one of the foremost of the present day, and that such endeavours are appreciated by the general public. Still there are probably not a few who will doubt if this desired supremacy is really worth the enormous cost of such vessels, when the reduction in the length of time taken in a voyage is so trifling.

However, to increase the speed of ships is a very desirable object, and great advances have been made in this direction within recent years. The now almost universal adoption of triple-expansion engines, with the accompanying saving in the consumption of coal, has proved as great a success as the compound engine did in its day. Boilers have also been brought to a high state of efficiency under increased pressure, and the form of the latest fast vessels seems all that could be desired as regards speed. But although the screw-propeller has received a good deal of attention, notably the adoption of twin screws, still comparatively little is definitely known of its propulsive power. The propeller has been one of the most useful inventions which have been applied to a ship; but is it in its present form unable to be much improved upon? If so, may it not be time to consider if any more efficient means of driving a ship cannot be found? Many methods have been proposed and tried, but hitherto without success. This, however, need not prevent further investigation of this interesting as well as useful problem.

Should the present form of propeller ever be superseded by some more effective appliance, it will certainly be a notable event. May it not, however, be possible?

THE LAW CONCERNING MARINE ENGINEERS IN CONNECTION WITH SHIPPING CASUALTIES.

(*Continued from page* 234.)

In August, 1880, there was an inquiry into the loss of life on board the screw steamer *Meredith*, of 634 tons register. This ship arrived at Gravesend from the Tyne; and as she was about to proceed to London, the chief engineer instructed the second engineer to open the main stop-valves upon the boilers. Whilst the second engineer was occupied in performing this task a rush of steam and boiling water, owing to the sudden lifting of one or both of the safety-valves occasioned him injuries of which he died. It was decided that the safety-valves were not in proper order, that the lifting gear of one of such worked so stiffly that it failed to be of use, that the covers of the boxes were most inefficiently fastened, and that the pressure gauges were unreliable; and the court censured the owner on this account. It was further held that the cause of the casualty was—(1) undue pressure in the boilers, and probable great variation of the pressure in one as compared with the other; and (2) the safety-valves hanging up and then becoming suddenly released and opening to such an extent as to cause the water to mix with the steam and rush out so violently that the escape-pipe failed to relieve the pressure, so that an imperfectly fastened cover of the valve box had such a strain brought upon it as to blow out the substance forming the joint, partially raise the lid and allow of the escape of steam and boiling water. The court blamed the chief engineer for his neglect in not ascertaining the load per square inch on the safety-valves, and in not getting up steam to lift the load on the safety-valves, to ascertain whether they and the gear connected with them were in good working order. It is declared to be the duty of steamship owners to see that the engines are alone entrusted to engineers holding Board of Trade certificates. They are also under the obligation, if they think proper to entrust the entire care of the engines to the chief engineers, to see that they are qualified to perform that work; while a man may be quite competent to take charge of the engines of a small steamer on a short voyage, but not qualified to be left in the uncontrolled management of such in harbour, without supervision. Irrespective of any statutory obligation, owners are bound to act as reasonable men, and as such they ought to adopt all means in their power to ascertain that the chief engineers whom they appoint are quite equal to the duties to be entrusted to them, and especially after they have ceased to employ a superintending or consulting engineer. If they like to dispense with the services of such a person, they should at least cause the ship to be regularly surveyed by Lloyd's surveyor or by some other qualified and independent person.

The *Jones Brothers*, No. 544, March 12, 1880.—In the case of the loss of life and damage from the explosion of a boiler on board a steamer of 743 tons register, at Bilbao, it was decided that efficient measures were not taken by the chief engineer to ascertain the thickness of the plates for a year before the explosion, and that on the day of the accident the boilers were worked at too high a pressure, namely 33 lbs., considering their condition. It was also declared by the court that the cause of the explosion was the bursting of the bottom plate of the port combustion-chamber, consequent upon the neglect to which the boilers had been subjected for some time, and to the reduction of that plate at the place of breakage to a bare sixteenth of an inch thick; and that the owners did not take proper steps to ensure the safety of the ship and her machinery, and were to blame for the explosion and loss of life that followed from the accident. The managing owner was condemned in £100 *nomine expensarum*, £50 towards the expenses of the court, and £50 towards those of the Board of Trade. (*Ibid.*)

The Merchant Shipping Act, 1854, as amended by subsequent statutes, give further powers than those before mentioned to cancel or suspend the certificates of engineers. Thus, a naval court may cancel or suspend an engineer's certificate, and so can a local marine board, as before stated, when upon any investigation by this body an engineer is reported to be incompetent, or to have been guilty of any grave act of misconduct, intoxication, or tyranny. If an engineer is proved to have been convicted of any criminal offence, or when he is superseded by any Admiralty court, his certificate may be so treated. Moreover, when upon any investigation made by any court or tribunal authorised by the legislative authority in any British possession to inquire into accusations of incompetency or misconduct of an engineer, a report is made by it that he has been guilty of any gross act of misconduct, drunkenness, or tyranny, or that the loss or abandonment of, or material injury to any ship, or loss of life, has been occasioned by his wrongful act or default, and the report is confirmed by the governor or person administering the government of such possession, his certificate may be cancelled or suspended.

The power of holding investigations into shipping casualties in British India and in British colonies, and concerning the conduct of certificated officers of steamships, depends partly upon Imperial legislation and partly upon Indian and colonial Acts or ordinances in force in the particular British possession wherein the inquiry is held. Statutory provisions concerning such investigations have been made in British India and the following British colonies, viz.:—Bahamas, Barbadoes, Bermuda, British Guiana, British Honduras, Canada, British Columbia, Nova Scotia, New Brunswick, Ontario, Prince Edward Island, Cape of Good Hope, Ceylon, Falkland Islands, Fiji, Grenada, Hong Kong, Jamaica, Leeward Islands, Antigua, Anguilla, Dominica, Malta, Mauritius, Natal, Newfoundland, New South Wales, New Zealand, Queensland, St. Lucia, St. Vincent, Sierra Leone, South Australia, Straits Settlements, Tasmania, Tobago, Trinidad, Turks and Caicos Islands, Victoria, Western Australia.

No certificate under the Merchant Shipping Acts is to be cancelled or suspended unless a copy of the report or a statement of the case upon which the inquiry is directed has been supplied to the owner of the certificate before the investigation begins, nor unless at least one assessor concurs in the report.

The Wreck Commissioner, justices, magistrate, board, court or tribunal by which the case is inquired into or determined, may require the engineer whose conduct is involved to deliver up his certificate, but he shall not be required to deliver it up unless it is suspended or cancelled, when he is bound to deliver it up upon demand under a penalty of £50. If the certificate is cancelled or suspended by the tribunal, it is to transmit the document to the Board of Trade, which may re-issue and return any certificate that has been cancelled or suspended, or shorten the time for which it is suspended, or issue a new certificate of a similar or any less grade in substitution thereof. This provision is an exceedingly important one, as it is reasonable to suppose that most of the courts or tribunals of first instance may not have the requisite knowledge or experience to satisfactorily investigate and adjudicate upon the certificate in question in all cases.

(To be concluded in our next number.)

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.

VISIT TO THE HARTLEPOOLS.

A WISE departure has been made by the youthful but enterprising North-East Coast Institution of Engineers and Shipbuilders from the ordinary routine of holding its meetings at Newcastle-on-Tyne and Sunderland. The initiative step of this departure is, we believe, due to Mr. J. R. Fothergill, of West Hartlepool, a member of the Council of the Institution; but it was at once heartily taken up by the local shipbuilders, engineers, manufacturers, &c., and owing to the liberality and public spiritedness of the latter, proved a complete success. The Council of the Institution have also largely assisted in the arrangements, and to them, as well as more especially to Mr. J. Duckitt, the genial secretary of the Institution, a meed of praise is due. The arrangements, it need not be said, were of the most complete character, and were, what is more important, ably carried out, on the whole good time being kept. A special train, leaving Newcastle-on-Tyne with upwards of one hundred of the Tyneside members received large additions of South Shields and Sunderland members on stopping at the railway station of the last-mentioned town. Altogether, including distinguished visitors from a distance and members and friends residing in the Hartlepool district, the entire company numbered nearly 250. On arriving at East Hartlepool Railway Station, the visitors were welcomed by the local reception committee, which consisted of W. Gray, Esq., the Mayor of West Hartlepool; T. Richardson, Jun., Esq., the Mayor of Hartlepool; T. Richardson, Esq., M.P. for the Hartlepools; G. H. Baines, Esq., of the Central Marine Engine Works; J. Bland, Esq., General Superintendent North Eastern Railway Company; A. Gladstone, Esq., of the West Hartlepool Iron and Steel Works; M. Gray, Esq., of the firm of, and G.

Jones, Esq., manager to Messrs. W. Gray & Co.; A. Leckie, Esq., R. Murray, Esq., J. L. Petersen, Esq., W. Richardson, Esq., of Messrs. Richardson & Sons; D. B. Morrison, Esq., manager to the last-mentioned firm; T. Mudd, Esq., manager of the Central Marine Engine Works; H. Withy, Esq., member of the firm of, and G. W. Sivewright, Esq., manager of, Messrs. Withy and Co.; and W. Thomlinson, Esq., of the Seaton Carew Iron Works.

Under the guidance of the more active members of the Reception Committee, the visitors left the railway station, and passed round the end of the Victoria Dock, the first constructed at Hartlepool, and opened in 1840. One of the first objects to attract attention was the steamship *Eugénie*, lying at one of the branch establishments of Messrs. Thomas Richardson & Sons, receiving her machinery, &c. This vessel has been constructed by Messrs. Raylton, Dixon & Co., of Middlesbrough, and the hull attracted special notice, owing to the adoption of overlapped butts in the shell plating—an economical and efficient practice which, despite prejudice, is fastly coming into vogue. A melancholy occurrence is associated with this branch works of Messrs. Richardson & Sons, at which substantial 60-ton sheer-legs are now placed. It was owing to the failure of the original sheer-legs that Mr. Robert Wyllie, the much-respected late manager of Messrs. T. Richardson & Sons, met his death. Wending our way through piles of pit props and other encumbrances on the dock sides, the party arrived opposite the dock offices, where, in course of time, the whole were safely ferried across the entrance to the Old Harbour (despite the overloading of the primitive ferry boats) to Middleton, which, owing to the formation of the system of docks, is now practically an island, on which are situated the shipbuilding yard of Messrs. Edward Withy & Co., and the extensive works of Messrs. T. Richardson & Sons. The party now divided, the major portion entering the last-mentioned works, although not a few first paid a brief visit to Messrs. Withy and Co.'s shipbuilding yard, where they were most courteously received by Councillor H. M. Withy, one of the firm, and by Mr. Sivewright, the manager, who vied with each other in explaining all the special features of interest. At the time of the visit there were three steamers over 300 ft. in length on the stocks, in various stages of progress, and one, the *Ursa* (launched the previous day), in the water. The latter is one of the "improved well-deckers," a speciality of this firm, and built on the cellular bottom and web frame principle. During the last ten years not one of this class of vessels has foundered, and they are most deservedly admitted to be the "safest" afloat.

The yard is replete with every appliance for carrying on work expeditiously and economically, a special feature being the considerable adoption of flanging, easily visible in the vessels in progress in connection with the floor plates of the cellular bottom, reverse bars by this means being dispensed with, a great saving in material and labour being obtained. We were informed that the operation of flanging was carried out without heating the material, which of course is the usual mild steel, Siemens-Martin. A feature in the shell plating of the vessels built in this yard is the length of the shell plates, which varies up to 24 and 26 ft. Instead of using chain cables in launching, Messrs. Edward Withy & Co. use strong steel wire rope checks, and were the first firm to make the departure, a practice which should, in the interests of shipowners at all events, if not of the safety of the lives of those engaged in the operations of launching, be universally insisted upon. Close alongside of the s.s. *Ursa* were a number of stockless anchors, for the use of which there is no stronger and more able advocate than Mr. Sivewright. The anchors in question are, however, deserving of special mention, as we understand they are 40 to 50 per cent. cheaper than any other anchor of the same class. They are known as Henry P. Parkes & Co.'s Automatic or Self-canting Anchor, and so much satisfaction have they afforded Messrs. Withy & Co., that they have been supplied to a large number of the steam-vessels built at their establishment. We content ourselves with only a passing mention of this speciality in ship-equipment, as we hope at an early date to give our readers a fully-illustrated description of it. The general and drawing offices of Messrs. Withy & Co. came in for a full share of attention, and here we find labour-saving arrangements again conspicuous. For recording the time that each official enters and leaves the works, there is a Llewellyn's patent timekeeper and marker placed near the ordinary entrance. In the ladies' department of the drawing office, cylindrical calculators, Amsler's integrator, &c., were seen, as well as the photographic arrangements for multiplying copies of tracings, &c. The artistic work—panel painting—on hand also came in for a share of attention, the firm having made its development a special feature, and for the purpose having provided natural objects, such as birds, &c., to guide the talented feminine designers in their tasks. Female labour is also utilised in the copying of records, making clear copies of iron orders, typo-writing, &c.

Messrs. T. Richardson and Sons' principal establishment, the Hartlepool Engine Works, almost adjoins the shipbuilding yard of Messrs. Edward Withy and Co.; and lying directly *en route* for the Central Marine Engine Works and Messrs. W. Gray and Co.'s Central Shipbuilding Yard, &c., the great bulk of the visitors passed through, many lingering for a considerable time, looking at the details of work in hand, and endeavouring to see the latest thing in eccentric straps, &c.

Before, however, giving an account of our visit, and the impressions received, some account of the development of the business of Messrs. T. Richardson and Sons may not be without interest to our readers.

It is fifty-six years ago that a start was first made by the late Thomas Richardson, father of the present Member of Parliament for the Hartlepools, by the erection of a small works at Castle Eden, at which the staple industry was iron-founding. Fourteen years later the location of the business was removed to Hartlepool, where during the following forty-two years it has continued to gradually expand, and to be developed into its present large and flourishing condition. Fortunately, as the years have rolled on, there has not been a great change in the *personnel* of the firm, which now consists of Thomas Richardson, Esq., M.P., and his sons, T. Richardson, Jun., Esq., mayor of Hartlepool, and W. Richardson, Esq.

As already indicated, iron-founding was the first branch of iron-manufactures entered into; but, soon, plant for railways and the building of stationary engines, principally for collieries, engaged the attention of the firm. Subsequently, the building of locomotive engines was started; and it was not until 1851, five years after the firm was located at Hartlepool, that their first marine engine was constructed. However, once having embarked in marine engineering, the progress was rapid; so much so, that ten years later it had become their chief manufacture. The enterprise displayed in the earlier days of the firm has not, however, been wanting at a later period; and as marine engineering has been developed by the introduction of the "compound" and "triple" expansion engines, Messrs. T. Richardson and Sons have been found to be well in the van. In 1883 they built their first "triple" expansion engine on three cranks for the s.s. *Para*, owned by Messrs. Steel, Young, and Co., of West Hartlepool, and immediately afterwards another of larger power for the Dutch Mail Company; and since then they have, with few exceptions, only constructed triple-expansion engines. Not only is the firm of Messrs. T. Richardson and Sons well known as the makers of new triple-expansion engines, it has also had an extensive and important experience in the converting of existing compound engines since the year 1885, when Messrs. T. Richardson and Sons altered the two cylinder compound engines of the Union Steamship Company's steamer *Anglian* into three-crank triple-expansion engines by the addition of a high-pressure cylinder with Wyllie's patent valve gear. So successful was the "conversion," that subsequently they have similarly treated six additional sets of engines of steamships engaged in the Cape Mail trade, owned by the Union Steamship Company. Several steamers belonging to the Castle and Orient Royal Mail Companies have also had their engines "converted," and new boilers of high pressure supplied by Messrs. T. Richardson and Sons, and similar services have been performed in the case of a number of ordinary mercantile steamers. The *Roslin Castle*, which some of the company visited, is one of the largest of these steamers, having engines with cylinders 36 in., 60 in., and 96 in. diameter, 60 in. stroke, and three double-ended boilers, each 14 ft. 4 in. diameter and 17 ft. 9 in. long. This firm was the first to construct three-crank triple-expansion engines for pumping purposes, building in 1886 a set of engines for the East London Waterworks.

In passing through Messrs. T. Richardson's works, the visitors were favourably impressed with the completeness of the arrangements, as, with the exception of the manufacturing from the raw material, all other operations are carried on in the Hartlepool Engine Works necessary to the construction of marine engines, including forging and casting work. The same remark holds true in the boiler department, excepting that the firm is indebted to the steel manufacturer for plates, &c.; all flanging, however, being performed on the premises. For specialities, such as Fox's patent corrugated and Purves' patent ribbed furnaces, resort is made to the respective makers, as well as for special machines in

the engine-room or boiler space, such as Chandler's patent combined engine and fan for forced draught, manufactured by Mr. F. D. Bumsted, engineer, Hednesford. Specimens of the aforementioned specialities were to be seen by the visitors.

The latest addition to the machines, and which has only been at work a few months, is a milling-machine in the boiler-shop, specially designed by the makers, Messrs. F. and J. Butterfield and Co., Keighley, for milling plate edges, and especially useful for performing this duty on the circumferential edges of boiler ends, plates, &c. The machine easily cuts a depth of ¼ in. from a plate 1¼ in. in thickness.

At the time of the visit there were twenty-two boilers visible in process of construction, principally of 160 lb. working pressure, and five sets of triple-expansion engines, two of which were about completely erected; all of which received considerable scrutiny.

The next establishment visited was the Central Marine Engine Works, which were built in 1883 and 1884. Commencing exactly at the time when triple-expansion engines were beginning to supersede the older compound type, the Central Marine Engineering Company were fortunate in being able at once to get up patterns for the triple type, their very first engine being on this principle. Since then over thirty sets of engines, ranging from 600 I.H.P. to 1,800 I.H.P., have been completed; and at the present time, owing to the "rush" into shipping, the consequent increased activity has necessitated the commencement of extensions to the works. A forge and stern-frame shop are also being added to the establishment. It is needless to say that the visitors were universally pleased with their inspection of these modern works, to which further reference need not be made, as they were fully described in a paper read by Mr. Thomas Mudd, at Sunderland, on "The Plan and Construction of Marine Engine Works."

Not far from the Central Marine Engine Works is the North-Eastern Railway Company's new graving dock, which attracted some of the visitors on the way to the adjoining Central Shipbuilding Yard of Messrs. W. Gray and Co. The latter commanded considerable attention, as in January, 1888, it was only as ballast-heap, while now it is occupied by three vessels over 300 ft. in length, one in such an advanced stage of progress that it is expected to be launched in November. Seeing that the foundations of the berths and buildings had to be piled, such rapid progress speaks well for Mr. G. Jones, the shipbuilding manager of Messrs. W. Gray and Co. As all the machinery and plant is new, there were not a few objects of interest, more especially as they are adapted for plates 30 ft. in length and 7 ft. in width, the punching and shearing machines being double, triple, and quadruple acting. Amongst the novelties we noticed White's patent beam and angle planing-machine, by Messrs. Scriven and Co., Leeds. Hydraulic riveting is adopted by this firm, and has been for years, the framing being riveted at a fixed riveter, and the beams by a portable machine. The frame and plate furnaces are fired by gas, and the whole establishment is being fitted with the electric light.

Leaving this symmetrical and well-arranged shipbuilding yard behind, we passed, in a steam launch belonging to Messrs. W. Gray & Co., to the older establishment, where there are two graving docks and six berths. Here land is apparently very valuable; at all events, advantage has been taken of every available spot; but systematic arrangement is everywhere visible. The principal interest of this visit was centered in the bending of garboard or keel plates, when in a cold state, by a hydraulic bending-machine which, along with an accompanying crane, has been supplied by Messrs. Hugh Smith & Co., Fossil Works, Glasgow. Up to the date of the Institution's visit, it was doubtful whether the Committee of Lloyd's Register would sanction the "cold bending" of keel plates or garboard stroke plates; but on seeing the operation performed, and after subsequent examination of the material, Mr. B. Martell, chief surveyor, expressed his entire approval.

Time did not permit of our reaching the West Hartlepool Steel and Iron Company's works, nor the graving dock and shipbuilding yard of Messrs. Irvine & Co., as the time-table required our attendance at 6.30 p.m. at the Armoury, where an excellent dinner was provided for two hundred and fifty.

At eight o'clock the second ordinary meeting of the North-East Coast Institution of Engineers and Shipbuilders for the year 1888-9 was held in the Central Hall, West Hartlepool.

After words of welcome from the Mayor of West Hartlepool (W. Gray, Esq.), the President (F. C. Marshall, Esq.) took the chair; and the ordinary business having been transacted,

John Price, Esq., J.P., Mayor of Jarrow, member of the Council M.I.M.E., M.I.N.A., &c., read a paper on "The Use of Machinery in Construction."

This paper, as one of the after-speakers stated, was a further evidence of the versatility of Mr. Price, being an essay on Political Economy, and was well received, no portion of it being seriously questioned. Limits of space preclude its reproduction in our columns, and a short reference to it must suffice.

Taking 1871-3 as a starting period, Mr. Price stated there had been, subject to rises and falls (the latter never reaching the average lowness that prevailed before the rise), a steady and constant increase in the cost of hand labour in marine engineering, and yet, notwithstanding this increase and the increased cost due to the more costly types of engines now in vogue, the use of machine tools has brought down the total cost to less than it was in either 1865 or 1871. Comparing two equally busy periods, viz., 1873 and 1882, the total cost of the N.H.P. was reduced over 24 per cent., the cost of hand labour being reduced, not by paying lower rate of wages, but principally by employing machine tools, by as much as 35 per cent.

Portions of the paper regarding "Shipbuilding," which formed a text for Benjamin Martell, Esq., in the subsequent discussion, we reproduce *in extenso*:—

"In iron shipbuilding, the adaptation of the structure to the machine tool is an essential step to the extended application of machinery to construction.

"The iron and steel ship illustrates very broadly the slow conservatism that pervades English life. The structure of the iron vessel followed, as far as could be, the wooden vessel it replaced, in being formed of vertical transverse frames and horizontal planks or strakes. The structure of the steel ship perpetuates the system, only lengthening the individual plates. All regard for the principles of economic construction was overlooked at the outset, and was finally shut out, so that to-day it will require no mean struggle to obtain acceptance of a system of construction combining all needful strength with a more reasonable distribution of the material and a better command over the cost of production by the extensive use of the machine tool."

"There is a wide field in this department for the revision of the details of the structure and the adaptation of the machine tool." Having shown the respective permanent average increase of various classes of shipyard workmen, Mr. Price also pointed out that relatively to the cost per ton of deadweight, the percentage of hand-labour was, in 1865, 30·64 per cent.; in 1882, 1884 and 1886, 34 per cent.; and in 1887, 34¼ per cent.; so that "hand labour has run a close race" in "all the progress made by the manufacturer in supplying the market with a better and cheaper article—better and cheaper in spite of oppressive and repressive rules for construction."

These last words evoked the second inquiry from Mr. Martell in his speech: "I want to know what this means." But clearly he understood perfectly, as he assured the meeting that he should be happy to assist in any progressive steps in ship-construction, but pointed out that hitherto there had been no perfected system of longitudinal framing.

We regret we cannot refer further to the discussion, but must not omit the concluding portion of Mr. Price's paper, which is well worthy of being carefully pondered and acted upon by every manufacturer in the British Isles.

"Two considerations," said Mr. Price, "now demand that for the future a systematic application of the machine tool be made a cardinal principle of constructive work. These considerations are:—

"*Firstly*.—The necessity of controlling the cost of production and of cheapening it constantly. The competition with foreign manufacturers is fast leaving to the British manufacturer only his always advanced experience, which, up to the present in constructive work, remains supreme all round. This, as I have already said, must be embodied in the machine tool. The foreign workmen is equal to our own so far as mere manipulative skill goes, but although the physical and racial differences give our workmen an immense advantage, this is, as a matter of fact, already almost counterbalanced by the help of the machine tool alone, as it exists in the foreigner's hands, and it is actually found to-day to be *entirely* counterbalanced by the machine tool *and* cheaper living, and lower wages, abroad.

"Apart from foreign competition, however, it is essential to be able to control the cost and lessen it when needful to meet the regularly recurring periods of depression in trade, when he who can sell cheapest not only sells what he produces, but he also keeps the little trade there may be then at home.

"*Secondly*.—The necessity there is now of working the hugest constructive work, as well as the smallest, strictly on the arithmetic of commerce. We sell the largest cargo vessels with their machinery, as well as the ... llest, on a price per ton of

deadweight. The single ton is so small a unit, any error regarding it, being multiplied hundreds or thousands of times, becomes a formidable matter. This applies both to estimating and carrying on the work. But this method of basing a price on a unit of the whole thing to be sold is common to all constructive work, and is essential to commerce. We are, however, only now realising what this means in shipbuilding and engineering—how the disturbances and disputes in the labour market, and with labour, fritter away the small modern margins of profit—a condition of things which only the most perfect system of costing, and an extended application of the docile, untiring and perfectly reliable machine tool can avert from becoming disastrous. It has become necessary, therefore, to mechanically control as much of the cost of our structures as it is possible to do, and the great agent in aiding us is the machine tool."

NOBLE'S PATENT REVOLVING VALVE.

THE accompanying figures illustrate a form of steam valve somewhat unusual in the field of engineering practice, and very noteworthy when the valve itself, and the gear by which it is actuated, are considered. The valve, which is the invention of Mr. K. D. Noble, of Helensburgh, N.B., is a circular revolving one, designed as a substitute for the slide or piston valves now ordinarily fitted to steam cylinders.

The principal object which Mr. Noble has had before him, in designing this valve, has been to produce an arrangement whereby all the valves of a triple-expansion engine with three cylinders could be actuated from one point, and by one set of valve gear, in this way diminishing first cost, saving room, and obtaining clear open space about the guides of the engine. The arrangement of valve gear preferred by the designer, and one which has been found to answer very satisfactorily in practice, consists of a worm shaft carried along just below the valve casings, from which the valves of all the cylinders are actuated, the worm shaft being driven by a pitch chain from the crank-shaft. The gear for actuating may, however, be of almost any description, as the valve can be made to move either in one direction continuously or backwards and forwards through part of a revolution.

Before describing the valve itself, it may be proper to state that some little prejudice has been found to exist amongst engineers against the use of a pitch chain for actuating a valve. They imagine that the chain so employed is so tasked that it must needs rattle and stretch. Actual practice, however, has shown that neither of these things results. When properly designed for their work, the chain and its wheels run with the utmost smoothness and no perceptible noise. The valve, being almost perfectly balanced, revolves with freedom, and the chain has consequently no strain upon it, but hangs slack as it runs. If, however, by any chance, stress should be put upon it, and it is found to stretch, there is due provision in the links for taking up the extension. The use of the chain has distinct advantages over that of eccentric rods, or of shafting and wheels, one of the most obvious being the ease, rapidity, and cheapness with which any breakage can be made good. Indeed, if two chains be employed in place of the single one necessary, and one should break, it simply falls away, and the engines continue working as if nothing had happened. The broken link can be replaced by a new one in a few minutes. The consequences, on the other hand, of breakage or bending where the ordinary valve and eccentric rods are concerned, are too well known to need description.

By referring to our illustration (page 269) the form and disposition of this valve will at once be seen. The valve revolves upon a tube, which communicates with the steam-pipe. The steam is first admitted to the inside of the valve, and, after operating in the cylinder, is exhausted into the casing. To prevent the valve from being pushed off the cylinder face, a disc is placed at the back of the valve, and steam is admitted into the space between the disc and the casing cover. This steam is of the same pressure as that in the steam-pipe, so that the area of the disc can be made just sufficient to keep the valve against the cylinder face with any force desired.

The disc is held in position by two rings, one fixed to the casing and the other loose; and to keep the whole steam tight there is a covering of one or more sheets of thin copper or other suitable material. As long as the valve is in its proper position upon the cylinder face, the loose ring is supported just clear of the disc, so that the latter only can press upon the valve; but if the valve is moved away from the cylinder face, it has the pressure of both disc and loose ring to send it back to the face.

Steam may be admitted, if desired, into the space between the valve and the disc, to relieve the pressure upon the centres. If this is done, the safety faces must be touching; if not, they should be a little clear.

The object of the safety faces is to prevent escape of steam if the valve or disc should crack at the centre. The casing may be opened up and the valve taken out by breaking one joint only, and that is an exhaust-steam joint. The joint between the thin sheets and the casing cover never requires to be broken.

Easing gear may be fitted inside the inlet tube, if desired, so that the actual pressure of the valve upon the cylinder face may be ascertained at any time; and, by easing the valve a little more, the additional pressure of the loose ring may be known. The engine can be reversed with ease and rapidity by drawing the shaft a short distance endways. This may be done by means of a handle or a hand-wheel, or by steam starting gear; and its effect is to turn the valve round upon the face, through a small part of a revolution, into the position required for reversing. The motions of crank, valve gear, and valve are then all in the opposite direction. The engine is stopped by drawing the shaft half the distance, thus placing the valve in mid-position.

Trials made with this form of valve, actuated by the chain gear, on a horizontal stationery engine, having a 24 in. cylinder and 42 in. stroke, show it to be perfectly successful. This statement is borne out by the diagrams taken from this engine, which we here reproduce. Fig. 4 is the diagram taken from front of cylinder next crank, and Fig. 5 from the back. The revolutions of engine were 42, the steam pressure 42, and vacuum 22½. A small engine model, illustrating the principle of this valve, is shown in E gallery of the machinery section of the Glasgow Exhibition. It has been made by Mr. D. Carlaw, 54, Ropework Lane, Glasgow, who is prepared to apply the contrivance to small steam-engines of all kinds.

JUNIOR ENGINEERING SOCIETY.—At the opening meeting of the eighth session of the Junior Engineering Society, 64, Reedworth Street, Kennington, S.E., which took place at the Westminster Palace Hotel, last month, Professor W. C. Unwin, F.R.S., delivered a presidential address on "Illustrations of the Use of Theory in the Work of the Engineer."

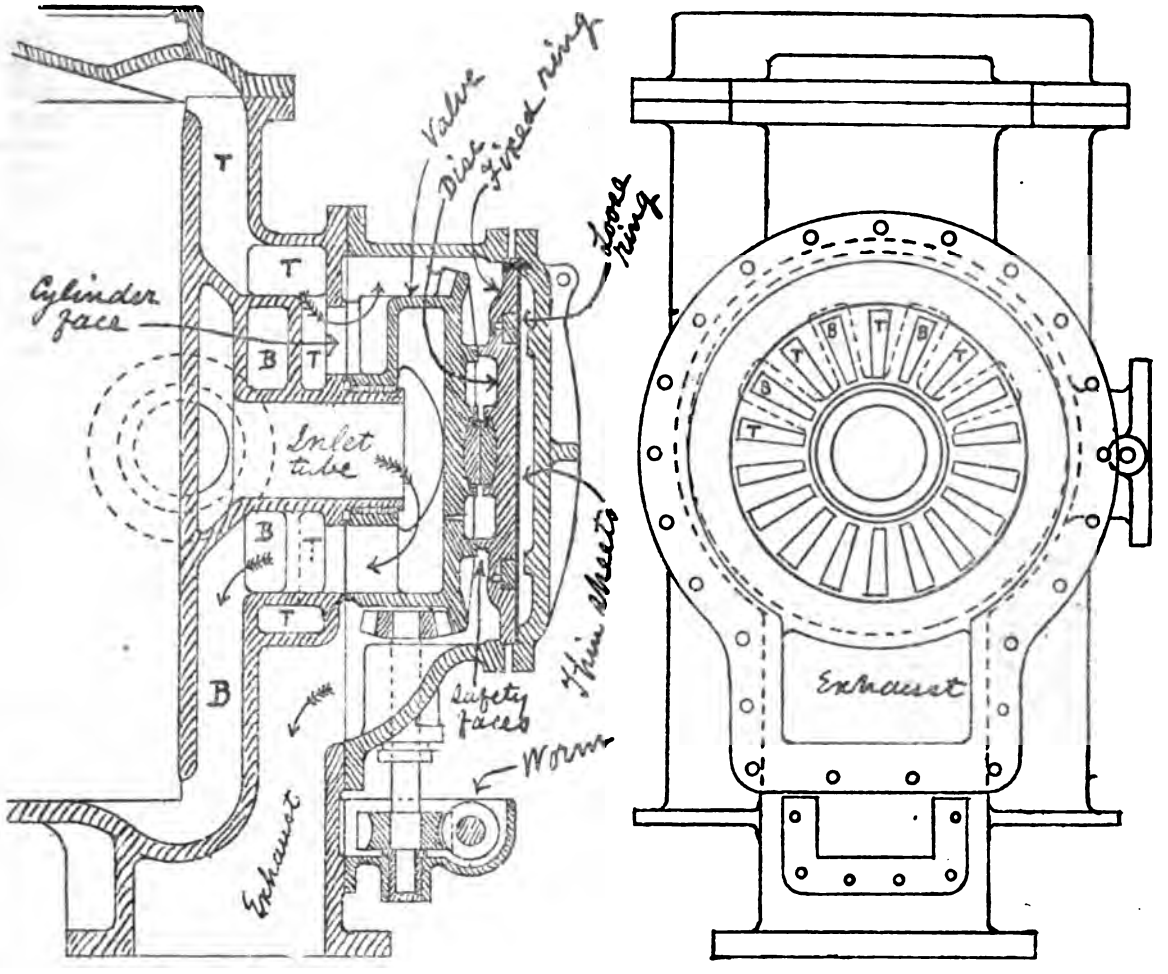


Fig. 1.

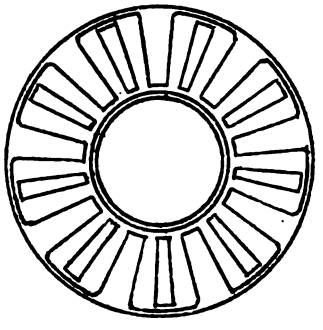


Fig. 2.

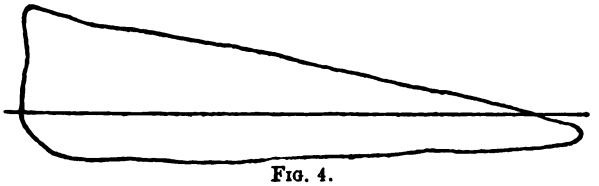


Fig. 4.

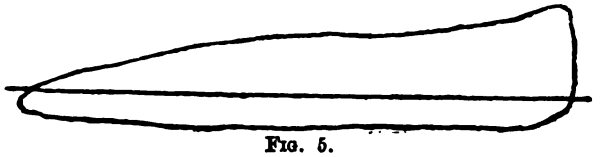


Fig. 5.

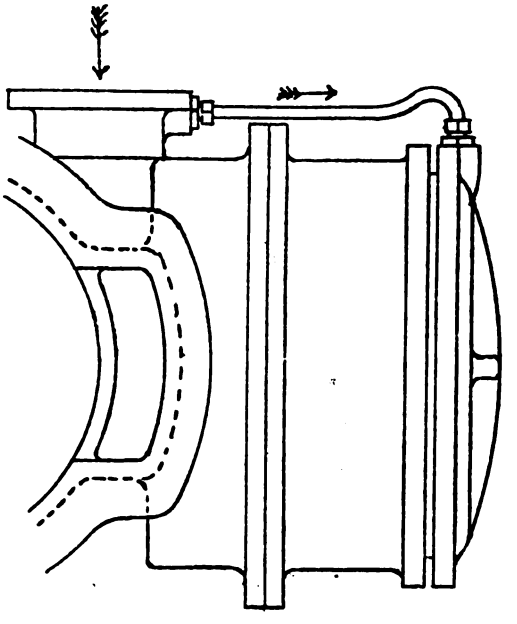


Fig. 3.

BELL'S ASBESTOS-PACKED COCK.

BAINES'S PATENT.

THE accompanying illustrations represent typically a novel method of manufacturing cocks and valves in which all liability to jam or "scour" the plug is most ingeniously and effectually overcome.

In these cocks, as will be seen from the figures, there is no metal-to-metal contact between the plug and barrel, hence it is impossible for the plug, however tightly packed it may be, to seize, a not unfrequent occurrence when using cocks fitted with taper plugs.

The advantages of Asbestos as a packing material are too well known to need any further comment here, but to provide a cock in which an even flow of the packing material to all the parts where it was required necessitated a special design altogether, and the inventor deserves congratulation for having solved the difficulty in so effective and at the same time simple a manner.

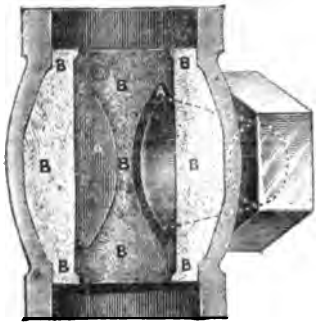


FIG. 1.

FIG. 3.

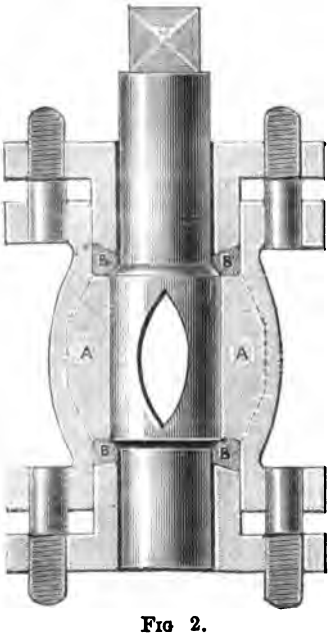


FIG 2.

The following description will show the method of construction. On the inner circumference or face of the shell are four oval projections A, having their top and bottom ends well pointed, as shown at Fig. 1, which is a section through the line, X Y, of Fig. 3. The grooves or channels, B, which receive the packing are thus made in wedge-shaped form, and they increase in depth as they decrease in width (*vide* A, Fig. 2), so that their traverse area is the same throughout their length. The packing, when compressed by the glands, flows easily along the grooves, B, and owing to their peculiar formation (which gives equal capacity at every point) it cannot become jammed. Further packing is added as required, as shown by the cross hatched rings, B, B, in Fig. 2, and this can be done while the cock is under pressure and without the aid of any special skill or caulking tools.

The asbestos packed cocks are made in various types and patterns, such as water gauge, boiler and cylinder cocks, main and angle cocks, blow off and fire cocks, &c., by the Bell's Asbestos Company, Limited, of 118, Southwark Street, London, S.E., and are stocked by them in sizes ranging from $\frac{3}{8}$ in. up to 8 in., the same principle of construction holding good in each case.

For working with the present high pressures these cocks are specially useful, as they afford perfect protection against the results of the well-known cutting action of high pressure steam, while even should metallic grip get in between the plug and the packing it becomes embedded in the latter and so reduces to a minimum the scoring action which is fatal in cocks whose barrel and plug are both of metal.

THE ELECTRIC LAUNCH VISCOUNTESS BURY.

THROUGH the courtesy of Messrs. Immisch and Co. we were recently afforded an opportunity of inspecting, in company with their chief engineer, the electric launch *Viscountess Bury*, now lying at Tagg's Island, Hampton.

The vessel, which is claimed to be the largest electrical vessel yet built, is 65 ft. 6 in. long with 10 ft. beam, and on a mean draught of water of 22 in. has a displacement of 12½ tons. She is built for passenger service, and will carry eighty passengers, though we should be inclined to think the limit of comfort would be reached with fifty on board. As we purpose fully illustrating this novel vessel in our next issue, we will here confine ourselves to generalities rather than go minutely into details. The vessel will be provided with 200 electrical accumulators, which will suffice to propel her by means of two "Immisch" motors at a speed of 6 miles for ten hours, or proportionately higher speed for less time.

The propellers, two in number, are three-bladed, built up of steel, of 12 in. pitch, and 2 ft. 3 in. diameter, and will run at 600 revolutions per minute.

Messrs. Immisch and Co. are also establishing charging-vessels and stations at different points on the Thames, where the accumulators of their vessels (for the *Viscountess Bury* is to be, if successful, the pioneer of a fleet) can be re-charged as required; but as we shall also illustrate these charging stations in our next, we shall confine ourselves to having mentioned them here.

THE "VICTORY."—Orders have been received at Portsmouth, directing the *Victory*, Nelson's famous flagship at Trafalgar, to be out of workmen's hands by November 23rd. Upwards of £10,000 has been expended upon the ship in making her watertight, and it is said that she will now last another 100 years.

STOCKLESS ANCHORS IN HAWSEPIPES.

IT frequently happens with the introduction of a new departure from old-established customs and modes of doing any particular kind of work, that serious errors at first accompany the change, and the alteration recently adopted in the system of working ships' anchors has proved no exception in this respect, as it has called into existence a numerous class of anchors, called stockless, designed by their makers and constructed on the cheapest possible principles to stow in hawsepipes, many of which, however, unfortunately lack the essential qualities of a good anchor. These anchors chiefly consist of a shank and two side arms of varying forms and attached in various ways thereto. It is quite unnecessary to theorize as to the want of good holding power in this description of anchor, for that has been proved beyond doubt by the trials of two-armed stockless anchors made by the Admiralty some time ago, which clearly showed their rolling-over tendency, and, as a result, the Admiralty deemed them unsafe and discontinued ordering them for use in the Service.

The advantages derivable from carrying anchors in hawsepipes (provided the anchors themselves are equal in holding power to the old-fashioned anchors) will scarcely be questioned by any practical man connected with shipping, as greater safety is thereby secured in being able to work the anchors with much greater rapidity, ease, and economy than the old style of fishing, catting, and heaving them up on to the forecastle. A further serious disadvantage entailed by the old plan of carrying anchors on the forecastle is that steamers' forecastles are frequently rendered leaky by the shaking motion, imparted by crane or davits in hoisting the anchors thereon; and it is a fact that even in the case of the best built vessels, some of our fine liners, their forecastles have been known to subside several inches with the superincumbent weight of their anchors, aggravated by heavy seas falling upon the forecastle, and in many instances the iron stanchions under the forecastle become bent and require to be strengthened by the addition of timber supports. Considering these drawbacks in the old style of working anchors it is scarcely to be wondered at if shipowners eagerly adopt a new system which they see will facilitate the working of their steamers; but it certainly becomes a case of "out of the frying-pan into the fire" when they find that, having made a change in the plan of working their anchors, they have got anchors on board their vessels which will not hold the ship in bad weather. Unfortunately this is often found to be the case with two-armed stockless anchors, especially where steamers require to moor in strong currents with a soft shifting bottom.

A stockless anchor is shown at the Glasgow Exhibition, Stand No. 329, Machinery Section (Tyzack's improved patent), which is designed expressly with a view to obviating the errors fallen into by the patentees of two-armed stockless anchors—by its having a third central arm (on the same axis as the lateral arms) which takes the strain in a direct line from the cable, thereby steadying the action of the lateral arms. This anchor, in practice, is found to attain the object for which it was designed, namely, to hold well in any ground without having a rolling-over tendency or losing its hold; and captains of large steamers (4000 tons deadweight) have testified by letter to the patentee that this anchor not only holds as well as ordinary stocked anchors, but even better, inasmuch as they have ridden safely with one anchor where other steamers near them have dragged with ordinary stocked anchors down. Tyzack's anchors are now extensively supplied to vessels of all sizes, from large war cruisers and merchant steamers carrying them in their hawsepipes to small yachts, and are so widely appreciated that the patentee has orders for 200 tons of them, at present being manufactured. Shipowners and superintendents desirous of supplying their steamers with thoroughly reliable ground gear, on visiting the Glasgow Exhibition have every opportunity of obtaining full information and examining the construction of this anchor at the stand above named.

THE "JUPITER" INDUSTRIAL LIGHT.

THE accompanying illustrations show a new form of apparatus for producing high-power lights for industrial purposes, which is now being put on the market by the Harden Star, Lewis & Sinclair Co., Limited, of 114, Cannon Street, E.C.

The "Jupiter" light is produced from very cheap materials, such as creosote oil, crude petroleum, tar oil, or other heavy hydrocarbons, and compressed air; the light being of a warm and brilliant nature, and varying, according to the apparatus used, from 100 to 2,500 candle power. With this arrangement there is no waste of oil, no escape of unconsumed oil spray, and consequently no damage to surrounding objects, while the light throws no black shadows, emits neither smoke or smell, and is scarcely affected by the state of the weather; in fact, when once started it is self-lighting, if by any means the light should be put out. This is due to the fact that the lamp burns gas, and not oil spray, the oil being converted into gas before it reaches the cones of the burner, the inner one of which is always red hot.

The first cost of the "Jupiter" plant is very low, the only appliances, other than the burners themselves, consisting of an air compressor and a receiver, while an expenditure of 2 H.P. provides air sufficient for lights equal to 10,000 candle power, and the consumption of oil ranges from one-half to two gallons per hour.

For breaks-down and marine salvage operations, or whenever a temporary illumination of great power is required at short notice, the lamp is arranged in conjunction with a portable hand air compressor, and this arrangement, when worked by two men, is capable of supplying one light of 1,200 actual candle power.

In our illustrations fig. 1 shows the lamp as mounted on top of a post or pillar, this form is specially suitable for use in shipyards; fig. 2 shows a 25-gallon lamp, burning 1½ gallons of oil per hour, and which may be placed on the ground in any convenient position, and fig. 3 shows a smaller lamp, having a capacity of ten gallons, and burning only three pints of oil per hour; while fig. 4 shows a very compact and strongly built air compressor, which only stands 3 ft. 6 in. high, by 1 ft. 6 in. wide, and supplies air sufficient for six 1,200 candle power lamps. The great economy of the "Jupiter" light is in part due to the fact that the air pressure at the lamp is only about 3 to 5 lbs., as against 15 lbs. or more in

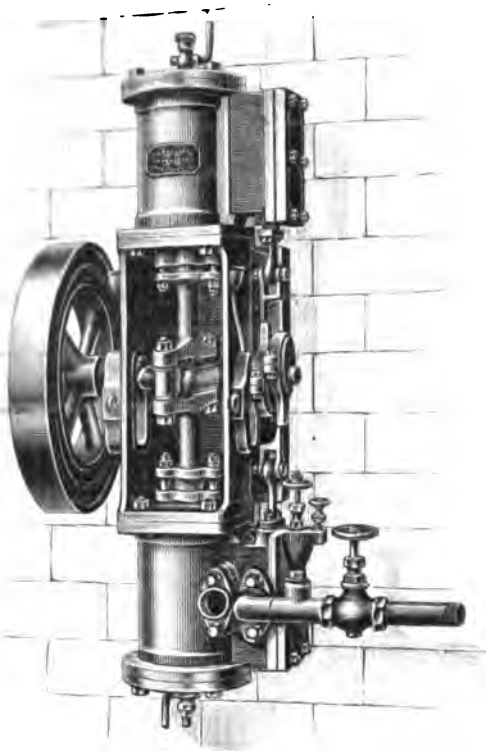


FIG. 4.

FIG. 2.

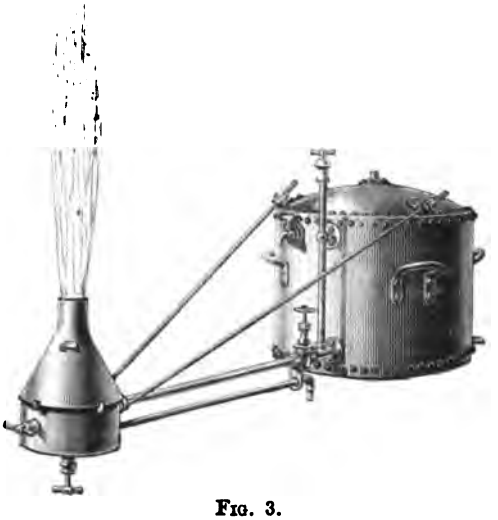


FIG. 3.

THE "JUPITER" INDUSTRIAL LIGHT.

other systems; and the large amount of induced current set up between the cones of the burner ensures perfect combustion of the gas. As proving this, if the air pressure becomes too high, by a few pounds only, the flame falls short and looses in luminosity.

To engineers, shipbuilders, contractors, dock companies, and other establishments of a similar nature, where it may be required to carry on operations as well by night as by day, the "Jupiter" light will prove most useful, and to all such we can cordially recommend it as being a cheap, powerful, and steady light.

STEVENS' PATENT RUDDER CONTROLLER.

WE recently inspected the arrangement of rudder controller, of which the accompanying illustrations represent two typical forms.

As will be seen, the invention is a very simple one,

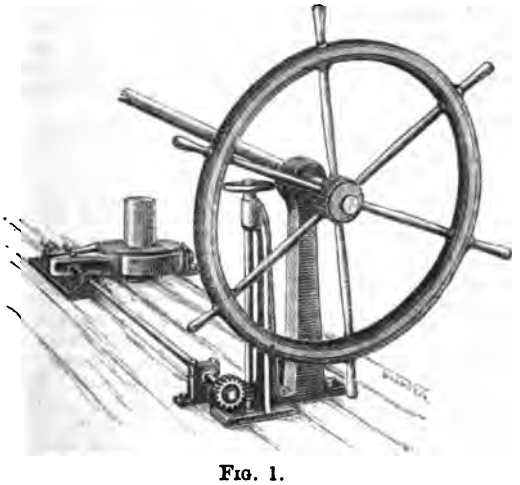


Fig. 1.

the additional parts being very few indeed, and consists in simply applying a friction band either to the steering-wheel spindle, as shown in Fig. 1, or to the rudder-head

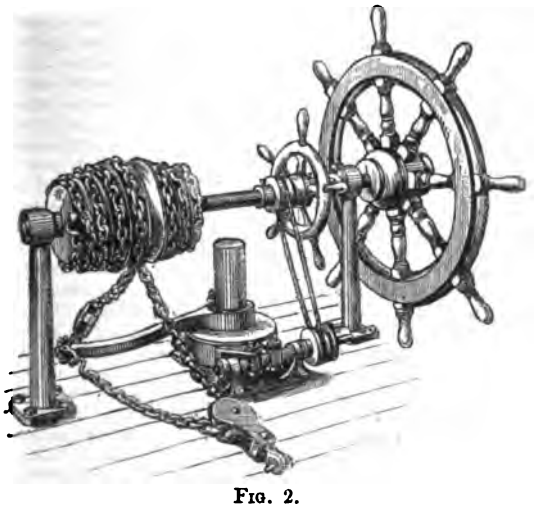


Fig. 2.

itself, as shown in Fig. 2; in either case the advantages are the same, namely, complete control over the rudder.

In steering in a heavy sea just sufficient friction is put on to keep all taut, and however hard the rudder may be struck the men at the wheel would not suffer, as is only too often the case with an uncontrolled rudder, from the effects of the blow.

Again, should a breakage of any chain occur, the rudder head, even with the rudder hard over, can be instantly gripped or seized before the rudder has had time to pass beyond the line of the keel, a fact of the utmost consequence, especially when in the trough of a sea; while, on the other hand, by graduating the pressure the rudder is allowed to slack off as required. In the case of yachts, smacks, barges, &c., the steering-wheel can be fixed and left when necessary, an advantage also in the case of steamers going full speed astern, while by the use of the controller the rudder can be kept perfectly still while the vessel is riding at anchor, thus preventing the wearing of the pintles and the jar which is such a fruitful source of annoyance to passengers.

By the use of the controller the necessity for relieving tackle is entirely done away with, and many advantages, impossible of attainment by the ordinary tackle, are placed within the helmsman's reach. The controller has been fitted on the steam yacht *Malika* (belonging to H. J. Barrett, Esq.), and it has, after a lengthy trial, given every satisfaction. It is to be seen at the Alexandra Palace (Exhibition of Life-Saving Appliances), and at the offices of Stevens' Rudder Controller, Limited, 37, Walbrook, E.C., where a full-sized gear is to be seen and tried.

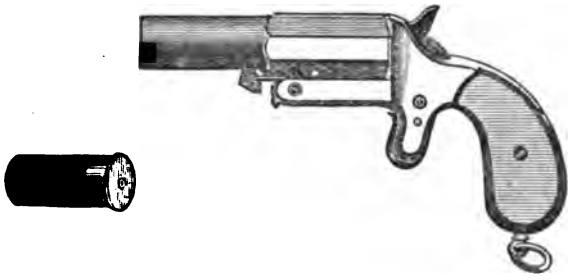
THE NEW NATIONAL LIFEBOAT INSTITUTION.

AN association bearing the above title, and whose present address is at the Alexandra Palace, Muswell Hill, London, has recently been formed with the object of supplying a class or type of boat more suited to the varying requirements of our coast than the present boats, in many instances, have proved themselves to be; in fact the new institution go so far as to say that, bearing in mind the many sad and fatal accidents to lifeboat crews of late, they will not rest until they have furnished the seafaring population along the coasts of Great Britain and Ireland with boats of a far more serviceable character and safer description than those adopted by the Royal National Lifeboat Institution; and as we hold that there is no finality to the inventative faculty, we trust that the new boats may fully realise the expectations of the promoters of the new institution.

The officers will be elected every three years by a representative of each of the local committees, elected by them for this purpose; and every attention will be paid to the wishes of the crews in supplying boats, each of which will be specially designed to meet their own particular situations and requirements, and by these means it is hoped to place in the hands of each crew a boat in which they may have every confidence. Prizes are now being offered to prove in rough seas which are really the best boats, and the Royal Institution, with others, are invited to compete, the conditions allowing boats of either home or foreign construction to enter for competition.

LIEUT. VERY'S PATENT PISTOL FOR NIGHT SIGNALLING.

AN opportunity was afforded us at a semi-private exhibition, recently given at Liverpool, of observing the great value, to the mercantile marine service in particular, of the above apparatus, invented and patented by Lieut. E. W. Very, of the United States Navy, and which has been slowly but no less surely superseding the ordinary old-fashioned ships' rockets. The contrivance, which we illustrate, consists of a large-bored brass breech-loading pistol, from which can be discharged brilliant fire-balls of red, green, white, or any colour desired, at a height or distance of between three or four hundred feet, and which will continue to burn while falling. The pistol, which can be discharged perpendicularly, or in any required direction, is fitted with a lanyard, and can thus be carried hung from the neck, while a leather belt, with fifty cartridges buckled round the waist, would enable any one of the crew or passengers of a wrecked vessel,



after mounting the rigging and securely lashing himself there, to discharge these signals at intervals throughout the night. The patent cartridges are protected from the wet by a strong brass casing, so that the contents will explode in all weathers, and being tipped with the colour of the signal required for the occasion, no error can possibly be made. The cartridges may be refilled for over forty times at the small cost of 5s. 6d. a dozen—a consideration not to be overlooked—and, after the first cost of the pistol is incurred, are much less expensive than rockets. Immediately after the loss of the *Indian Chief* and eighteen lives, Vice-Admiral J. R. Ward, chief inspector to the Royal National Lifeboat Institution, wrote to the *Times*, calling the attention of shipowners and masters to this excellent invention. The Vice-Admiral remarked that crews and passengers frequently have to take to the rigging to save their lives, and under such circumstances it was quite evident that guns, ordinary rockets, tar barrels, or ordinary lights of any description are useless, and that any available signal lights must be of such portable character as could be carried aloft and shown from the rigging or mast-head.

"The only certain means with which I am acquainted to accomplish this desirable end is the signal invented by Lieut. Very," remarked the Vice-Admiral. Apart from the question of saving life at sea, one of the most important aids to successful navigation by night is a reliable signal, and one that can be seen at a considerable distance Very's patent, when discharged, may be observed twenty miles off on a clear night. They are in general use in the British Army and Navy, in the Imperial Russian and United States Navies, and are to be found at all the stations of the Royal National Lifeboat Institution.

Messrs. Dyer and Robson, the pyrotechnists, of East Greenwich, London, and of 27, King Street, Liverpool, who are the sole manufacturers of these pistols and cartridges, are so thoroughly convinced of their superiority and cheapness—after the first trifling cost of the pistol is incurred—that they announce their willingness to gladly forward, on approval, a specimen, so that the assertion may be tested and verified.

SPEED TRIALS OF TORPEDO BOATS FOR INDIA.

ON October 12th the speed trials of a new first-class torpedo boat, built of steel—one of three being built for the Government of India by Messrs. John Thornycroft & Co., of Chiswick—were made on the Thames, in the Lower Hope, opposite Canvey Island, between Southend and Thames Haven. The boat thus tried is at present unnamed, but is known as No. 257 of the Messrs. Thornycroft, No. 2 of the Government of India, that Government having ordered seven, of which three are to be built at Chiswick, three at Cowes, and one at Paisley. The vessel, to which the name of "boat" seems almost inapplicable, she being 133½ ft. in length, started from Chiswick in the mist of early morning, shipped her inspectors and visitors at Westminster, and then bore on for the open river below Gravesend.

The vessel was in charge of Mr. Tweddle and Mr. Barnaby (the latter the son of Sir Nathaniel Barnaby, late Chief Constructor of Her Majesty's Navy), and Mr. Brown had charge of the machinery. Mr. Smale and Mr. Melrose, the Admiralty inspectors, attended on behalf of the Indian Government, and there were also present Captain Eardley Wilmot, R.N., of the Intelligence Department of the Royal Navy, and Captain Rosseau, of the Austrian Imperial Navy, the Naval Attaché of the Austrian Embassy. The vessel manœuvred splendidly through the crowded pool, and was under steam steering gear, which allowed her to keep her speed pretty evenly and to run past obstructions safely. She has, for this class of vessel, an exceptionally large beam of 14 ft. 9 in., but is to the eye a long and narrow craft. She is of this beam in order to carry a heavy deck armament, so that she may be of a dual use as either a gunboat or a torpedo boat, and to give full advantage to a great rudder power with which she is supplied. She is fitted, as the three Chiswick vessels will be, with the Thornycroft side rudders, which, besides enabling the boats to steer with remarkable facility either astern or ahead, possess, in conjunction with a bottom guard, the very important advantage of completely protecting the propeller from the danger of fouling by ropes, nets, or other floating obstructions. The armament of the vessel is to be the same as that of recent boats built for the Royal Navy of this class, namely, four revolving deck tubes and one fixed bow tube, all discharging fourteen Whitehead torpedoes by means of a gunpowder impulse. There is a raised deck nearly the whole length of the vessel, and two conning towers, one fore and one aft. On these will be mounted the larger calibre Nordenfelt guns and other effective weapons for her use as a gunboat. In the conning towers are the means of steering by steam or hand, and she can be steered from fore and aft at both places by either steam or hand, so that if the steam steering should break down the hand steering can be resorted to. The complement of the vessel is three officers and thirteen men, and the load carried yesterday was twenty tons, including ten tons of coal; but she can carry twenty tons of coal, which would enable her to run, it was estimated on her guaranteed speed (22 knots), 3,000 knots. Her propelling machinery consists of 1,300 I.H.P. triple expansion engines, the steam being supplied by two of the firm's patent water-tube boilers. These boilers take up the same amount of room as a single locomotive of the same power, and the two increase the boat's chances of existence, as with one boiler disabled she could still steam at 18 knots, on the estimate that her guaranteed power of 22 knots was reached. The boilers have an exceptionally large heating surface, three square ft. per I.H.P., and are regarded as requiring a very moderate wind pressure, the manometer in the stokehold registering only from 1 to 1½. There has not been, it is significant to observe, any difficulty experienced with these boilers, either in the way of leaky tubes or priming and the danger of accident through faulty management is greatly reduced. The weight of the vessel and load was about 96 tons.

Gravesend was reached a little after noon, the passage down having been difficult owing to the crowd of vessels running up with the tide, and at twenty minutes past she commenced her fast steaming. She threw the spray about as she went through the water at 22 knots, or about 25 miles an hour, and when the measured knot was reached in the Lower Hope the speed was timed. She went one way against the tide, and the other against the wind, and the knots backward and forward were done in 2 min. 36 sec. and 2 min. 41½ sec. respectively. She went seaward between these runs, and turned speedily and so sharply as to send the spray over the decks. The same course was run a second time, the first knot being run in 2 min. 28 sec., and the second in 2 min. 45 sec. The next runs were made in 2 min. 24 sec. and 2 min. 51½ sec. The mean of all the running was 23·156 knots as against the guaranteed speed of 22 knots. She was then tried full speed astern, and she was steered by hand and by steam, both fore and aft, and continuous trials were made of the vessel's turning power, which were watched with amazement by the vessels of all nations passing up the Lower Hope. She went in circles from head to port in 1 min. 26 sec., from head to starboard in 1 min. 23 sec., from stern to port in 1 min. 43 sec., and from stem to starboard in 1 min. 29 sec. Her manœuvring power was regarded as excellent.

The vessel returned to Chiswick at night, and the inspectors expressed themselves quite satisfied after the exhaustive experiments with the vessel.

INCREASE OF MERCHANT SHIPBUILDING IN THE UNITED STATES FOR THE LAKE, RIVER, AND COAST TRADE.

THE material increase of shipbuilding for the mercantile marine of the United States during the present year is well worthy of notice. An authentic account of this is given with important details by Mr. Morton, the Commissioner of Navigation, for the six months ending September 1st, 1888, both as regards the lake trade and other geographical divisions. The more important part of these particulars we will now notify. According to the returns of this official, 581 new ships, including steamers and sailing vessels aggregating 150,110 tons, were registered during the six months from March 1st to September 1st, 1888, as compared to 471 ships of 105,234 tons during the corresponding period of 1887. Of this significant increase of 110 ships of 44,876 tonnage, by far the larger proportion was for the Lake trade, the increase in that department alone being 62 ships of a tonnage of 40,881. Separating the two classes of shipping, steam and sail, the new steam tonnage exceeded that of last year's corresponding period by 33,200 tons, while the sailing tonnage was 12,400 tons more.

The average tonnage of new steamers in 1888 has been about 376 tons, as compared to 355 tons in 1887. The dimensions of sailing vessels have increased more in proportion. These new ships in 1888 have averaged 124 tons, as compared to 89 in the previous year. Regarding, however, the Lake trade alone, the average size of the new steamers has diminished from about 693 tons to 687 tons, while the average size of sailing vessels has increased from 93 tons to 272 tons.

In addition to the greater activity on the Lakes, there has been a noticeable increase in the number of new ships registered in New England, while the shipbuilding for the Pacific Coast has more than doubled. On the Western rivers there has also been a slight increase of shipbuilding. The trade, however, appears to have declined more than 30 per cent. from last year in the middle Atlantic and Gulf division. According, however, to the latest returns from the Delaware and other shipbuilding yards within this district, "the boom has been struck" at last, and the middle Atlantic shipping interests will no longer lag behind the record of recent years. The unfavourable return made by this division is greatly owing to the fact that ships built within its area are registered in other districts where their service is performed.

The most trustworthy and competent persons in the United States shipbuilding industry think that continued progress will be made in this home trade, and that there is no fear of overproduction of ships, as the demand for new tonnage is the outgrowth of legitimate increase of business—of tendencies of a non-speculative and permanent kind. The new ships are said to be employed at unusual profit, and in several branches of shipping there are requisitions for a large increase. The following is a tabulated statement prepared under the direction of the Commissioner of Navigation:—

Comparative Statement of Number and Tonnage of Vessels registered during the six months ending Sept. 1st, 1888, and Sept. 1st, 1887:—

STEAM VESSELS.

Division.	1888. No.	1888. Tonnage.	1887. No.	1887. Tonnage.
New England	25	5,617	21	4,189
Middle Atlantic and Gulf ...	79	13,385	71	20,964
Pacific Coast...	44	10,026	32	4,113
Northern Lakes 120		82,550	71	49,224
Western Rivers	44	6,004	42	5,872
Total 312		117,582	237	84,362

SAILING VESSELS.

Division.	1888. No.	1888. Tonnage.	1887. No.	1887. Tonnage.
New England	65	12,796	58	10,877
Middle Atlantic and Gulf ...130		3,302	130	4,206
Pacific Coast...	39	6,790	24	3,734
Northern Lakes	35	9,610	22	20,872
Total 269		32,498	234	39,689

The above particulars will no doubt be interesting to readers of all nations in which a material amount of shipbuilding is carried on. They clearly indicate an important revival in the American domestic shipping trade, which has occurred sooner than has been generally expected by the mercantile marine community. Notwithstanding the recent immense extension of the American railway system, water carriage still holds its own. So far, however, as oceanic passenger and cargo steamers are concerned, there is no fear of competition to be dreaded in the near future between American and British and Irish shipbuilders.

THE UNITED STATES NAVY.

WHEN one speaks about the Navy of the United States he is often answered by the derisive question, "Has the United States a Navy?" According to the remarks of the Secretary of this Navy, and recent correspondence on the question, there is much cause for the people of this and other nations doubting the existence of any maritime defence worth considering by the great Transatlantic republic.

Two years ago, when Congress passed an extraordinary vote for naval construction and armament, there was not a steel-built steamer afloat for the United States Navy, while none of the eighty or ninety composite corvettes, sailing vessels, or monitors which formed the fleet could, says a correspondent of the *Pall Mall Gazette*, "have opposed for half an hour the quick-firing guns of a modern torpedo boat." The only war ships of importance possessed by the United States are the *Boston*, *Atlanta*, and *Chicago*, three partially protected cruisers of modern type of armament. None of them, however, could be ready for battle in less than six or nine months. With the sum of £2,259,300 voted for naval purposes in 1886, contracts have been entered into for the construction of two armoured men-of-war, five first-class protected cruisers, four gunboat cruisers, one dynamite cruiser, and one first-class torpedo boat. These ships are to be completed within periods varying from one to two years from the dates of the contract. Their completion, however, is likely to be postponed for considerable periods beyond the days when they are arranged to be finished. The keels of the armoured ships have not even yet been laid.

The Government of the United States are very blameworthy for neglecting to provide a navy worthy the name, considering that she has a valuable mercantile marine, a seaboard of 13,000 miles, and that every one of its coast cities is at the mercy of any small fleet of good battle-ships provided with first-class guns. It is truly stated that the defence of New York is so weak that even the fleet of China or Chili could destroy a great portion of the city without running any serious risk. Although the chances of our Transatlantic brethren having to defend themselves against a first-class maritime power are exceedingly small, they are under the obligation of providing themselves an adequate navy on account of the vast interests they have at stake, which are at the mercy of any third-rate naval powers with efficient battle-ships and ordnance.

LAUNCH OF THE RE UMBERTO.

ON October 17th the *Re Umberto* was launched at Castellamare in the presence of the Emperor William and King Humbert. She is a steel built, twin-screw, deck-protected, barbette ship of 13,298 tons displacement, and is very little smaller than the *Italia*, which was launched also at Castellamare in 1880, and the *Lepanto*, which was launched at Leghorn in 1882. As far as beam alone is concerned she is bigger than either of those leviathans; and in this respect there is nothing afloat that can rival her. Her dimensions are:—Length, 400 ft. 4 in., breadth, 76 ft. 9 in.; and her mean draught of water with all her weights on board is expected to be 28 ft. 8 in. She cannot fairly be ranked as an ironclad, seeing that she has absolutely no side armour at the water line. A large amount of protection is, however, afforded to her by the construction of her bottom and sides, by the subdivision of her hull into a great number of watertight compartments, and by a curved steel deck in the neighbourhood of the water-line. The ship's bottom is composed of three skins, which form two watertight spaces that are further sub-divided transversely. Experiments to test this mode of construction were made several years ago in Spezzia harbour. A caisson, built up in a similar way, was moored, and a charge of 75 lb. of gun-cotton was exploded in contact with it, and at a suitable depth. The two outer skins were ruptured, but the inner skin remained intact. Subsequently the inner one of the two spaces was filled with coal, and the experiment was repeated. This time only the outer skin was shattered. It may, therefore, be taken as proved that the construction of the *Re Umberto* affords protection against a torpedo charged with not more than 75 lb. of gun-cotton. The armoured deck leaves the ship's side 6 ft. below the water line, and curves upwards, until, along the middle line of the ship, it is but 2 ft. below the water line. It is formed of a ⅝-in. steel plate, overlaid by a 2 ⅝-in. compound plate. Below this deck and between it and the ship's bottom there are over 50 watertight compartments. Between the armoured deck and the deck immediately above it there are 100 other watertight compartments. If, therefore, water were to enter the ship either above or below the protective deck, its volume and evil effects might, with proper precaution, be strictly limited. The chief part of the armament will be carried in two barbettes, one forward and the other aft, on the middle line of the vessel. Each of these barbettes will be plated with compound armour 19 in. in thickness, placed at an angle of 24 deg. from the vertical. The ammunition hoist between the armoured deck and the barbettes will also be armoured, and the bases of the funnels will have substantial protection to a height of over 3 ft. above the water line. Beyond this the vessel will have no armour.

The engines, which are being manufactured by Messrs. Maudslay, are designed to be of 19,500 I.H.P. They are of the compound triple-expansion type, and are arranged in two sets to each propeller-shaft, so that when the vessel is to cruise under economical steam the forward sets on each side can be disconnected. The diameter of the cylinders is 47 in. and 89 in.; the stroke is 51 in. The valves are driven by Joy's valve gear on the swing-link system, as in *Andrea Doria* and her two sister-ships, also belonging to the Italian navy. It is expected that these engines will drive the ship at an extreme speed of 18 knots. The coal capacity of the vessel is 1,200 tons.

The armament of the *Re Umberto*, in addition to a ram, will comprise four 17 in. new model 104-ton Armstrong breechloaders, two being mounted in each barbette; 12 6·1 in. Armstrong 4½-ton breechloaders, carried in the batteries; 6 3 in. guns, and 10 machine and quick-firing guns, together with torpedoes. The so-called 104-ton gun—that is not its exact weight—has a total length of 40 ft. 9 in., the length of the rifled bore being 28 ft. 10 2-3 in., and of the powder chamber 7 ft. 6 in. The number of grooves in the rifling is 80, and they have a twist of 1 in 50 calibres, or in other words of one revolution in 70 ft. 10 in. The full firing charge for the armour-piercing projectile is 900 lb. of progressive Fossano powder; for common shell it is 600 lb. The projectiles weigh 2,000 lb. each. The bursting charge of the armour-piercing projectile is 32 lb., of the common shell 60 lb., and of the shrapnel 5 lb. The muzzle velocity of the gun, when fired with the full charge, is 1,992 ft. per second. The muzzle energy is 55,030 foot tons—sufficient to raise the *Re Umberto*, guns and all, more than four feet out of the water; and the projectile, at the muzzle of the gun, is capable of perforating 33½ in. of wrought iron. These heavy guns will be carried at a height of 28 ft. above the surface of the water.

The *Re Umberto* is to be completed for sea in 1892. Her design, which is also that of her sister ships, the *Sicilia* and the *Sardegna*, and of her kindred, the *Italia* and the *Lepanto*, has excited much criticism; and many competent judges have not hesitated to express an opinion that in the line of battle a vessel of this description would be dangerously out of place. Yet, if the *Re Umberto* is not useful as a battle ship, it is hard to see what she can be useful for. Writing in the August number of the *Jahrbücher für die deutsche Armee und Marine*, Herr Spiridion Gopcevic denies her utility altogether. She is, he declares, neither a battleship nor a cruiser. She is not a battleship for the reason that her sides are entirely unarmoured. She is not a cruiser for the reason that she does not carry sufficient coal. She is, moreover, too costly to be risked on cruiser's work. For the cost of a single *Italia* or *Re Umberto*, four ironclads, each of about 3,500 tons, might, he thinks, be built. Their united strength in artillery might equal that of the big ship; and, if that were so, they would, he maintains, be together much more than a match for the monster. There would be four vessels—that is, four rams against one; and it is hard to believe that, even if she were successful in one or two cases, the large vessel would put out of action or sink all her opponents before being herself sunk. Nay, more, the single ship, in this comparison, labours under the considerable disadvantages of being unable to divide herself and to be in four places at once. She is the less able, therefore, to enforce a blockade. Her draught of water debars her from many ports and waters, her size from many docks. She takes four times as long as a small vessel to build. Whenever she is under repair, a four-fold strength is doomed to lie idle. Herr Gopcevic urges all this, and much more, against huge unarmoured ships; and, doubtless, Italy has run some risk in investing so much money in them as she has invested during the last twelve years. Her navy is not, and never can be, strong enough to theoretically justify her in putting more than comparatively few eggs into one basket. Nevertheless, the *Re Umberto*, for offensive purposes at least, deserves to be called a most formidable ship, if only because she will, when completed, throw a heavier weight of shot than any ship that has yet been built. Including all guns of 6 in. calibre and over, the gun-strength of the most heavily armed battleships of the naval Powers is as follows:—

	Weight of Discharge.	Muzzle-energy of Discharge.
Re Umberto (Italian)	8,960 lb.	236,896 foot tons
Amiral Baudin (French) ...	5,950 ,,	124,770 ,,
Victoria (British)	5,176 ,,	132,632 ,,
Deutschland (German) ...	3,864 ,,	66,530 ,,
Tchesme (Russian)	4,988 ,,	123,772 ,,
Krp. Rudolf (Austrian) ...	3,000 ,,	57,000 ,,

This comparison, even if no other elements be taken, is sufficient to show that, whatever may be the weaknesses and demerits of the *Re Umberto*, she is a very dangerous adversary and a very remarkable ship.

TRIAL OF A TORPEDO BOAT ON THE CLYDE.

ON October 20th a new first-class torpedo boat, built by Messrs. Hanna, Donald and Wilson at Paisley, for the Indian Government, went down the Firth on a trial run. For a trial of speed the day was very fine, as there was no wind, and the sea was therefore calm; but the slight mist which hung around deprived the guests of a view of the scenery of the Clyde, doubly beautiful at present when all is clad in autumn foliage. The little craft—which, by the way, has not yet got its name—left the James Watt Dock shortly after noon, and steamed at a brisk pace past the Channel Fleet and down the Firth. Her appearance, which, like all torpedo boats, is stealthy, attracted much attention. She is both narrow and shallow for her length, and having at present only her short funnel and a polemast, with rails instead of bulwarks, not much of her was seen as she glided swiftly along. As to dimensions and details, &c., the builders' lips are sealed, the reason always assigned for reticence on such occasions being that foreign governments might learn from the journals of the day the details of the boat; but before the vessel has been long on commission all will be known by

those anxious to learn and willing to probe all sources. The vessel is built of galvanized steel of varied thickness, but generally speaking very thin, and internally it is coated with a composition, and covered with small cuttings of cork, which not only prevents dampness, but gives the "walls" of the saloon, &c., a pretty appearance. In writing of such a craft it is almost impossible to dissociate from the mind the work she may be engaged in. It must be either offensive or defensive. In both cases speed is of great importance, for she occupies pretty much the position of the hero "who fights and runs away" so as to be able "to fight another day." Her engines are of the triple-expansion type, with inverted direct-acting cylinders, and every appliance has been adopted to render them compact and strong. The valves are driven by Joy's valve gear. The propeller, which is of steel, has only two blades. There is one boiler of the locomotive type working to a pressure of 180 lb. per square inch. Force draught, on the closed stokehole system, is brought into service. The boiler is fed only by fresh water, condensed by the apparatus of Mr. Kirkaldy and now on view at the Exhibition. The water is stored in a galvanised iron tank, which is so shaped as to form a seat in the engine-room. For protection the coal bunkers are placed on either side of the boiler and across the fore end. The vessel depends almost entirely on the subdivision of the hull into watertight compartments, there being fourteen of these. There are in the larger spaces ejectors for pumping the ship dry when necessary. The vessel is steered by Pefel's patent gearing, placed on the side of the bulkhead in the engine-room, operating a rudder on the balance principle. Both the speed and manœuvring powers of the vessel were recently tried by Government inspectors, when considerably over the stipulated speed was attained, and on Saturday on the measured mile at Skelmorlie three runs were made, the mean speed being equal to 20¼ knots per hour, but the engines were not worked up to their full power. The fighting capabilities of the ship are not yet evident, as her guns have not arrived. She will have 3-pounder and several Nordenfelt guns, besides five torpedo tubes. One of these is placed at the bow, and two will be attached to each of the two conning towers—one forward and one aft. These latter tubes will be so placed that they can be fired in any direction. A search light will also be supplied. The vessel can be steered and worked from either of the conning towers or on deck. The comfort of the officers and crew has not been neglected, for aft there is a large saloon and forward accommodation is provided for the "tars." Electric light is provided by a powerful dynamo placed in a forward compartment. In addition to the guns, several deck erections have yet to be placed in position; and the vessel will also be fitted with awnings. The completing of these operations will necessarily take some time, so that the little craft will not sail for Calcutta, where she is to go on commission, for a month or two. It may be added that this is the first torpedo boat of the type built on the Clyde, Thames builders having hitherto monopolised this work.

LAUNCH OF THE TWIN-SCREW STEAMERS RIO BRANCO AND JOAO ALFREDO.

ON September 27th, Messrs. Russell & Co. launched two finely modelled twin screw steamers, named *Rio Branco* and *Joao Alfredo*, for the Amazon Steam Navigation Company (Limited), for the passenger and cargo trade in the river Amazon. The dimensions are as follows:—Length between perpendiculars, 200 ft.; breadth on deck, 36 ft.; breadth on waterline, 31 ft.; and depth moulded to main deck, 10 ft. 1 in. These vessels are fitted up in first-class style as passenger steamers, having accommodation for 57 first-class and a large number of third-class passengers. The state-rooms are fitted with Shanks' patent lavatories, and the patent turn-up folding berths are supplied by Messrs. J. G. Rowan & Co., of Greenock. The wood work is entirely of teak, there being no other class of wood used in any part of the vessels. They are also fitted with all modern appliances for the rapid discharge of cargo, of which they carry 200 tons. Gibb's patent upcast ventilators are fitted to each hold, and the thorough ventilation of the state-rooms has been carefully attended to. The vessels are subdivided by eight transverse watertight and one longitudinal bulkhead, which ensure the safety of the vessels in case of collision, &c. Messrs. Rankin and Blackmore, Greenock, will supply the machinery, which consists of four sets of triple-expansion engines, with cylinders 13, 20, 32, by 24 in. stroke, and two double-ended boilers 15 ft. 6 in. long by 12 ft. diameter, 160 lb. pressure, and which are guaranteed to drive the vessel at a speed of 12 knots. They have also a cestus boiler for auxiliary purposes. The vessels, which will be fitted out for sea at Greenock, will be ready about the end of October. The *Rio Branco* was gracefully christened by the Countess de la Warr, and the *Joao Alfredo* by Lady Edeline Sackville. Amongst those present at the launch were—The Earl and Countess de la Warr, Lady Edeline Sackville, and Lady Mary Sackville; Admiral Sir E. A. Inglefield, K.C.B., and Adolph Klingelhoefon, Esq. (directors of the company); William Withered, Esq., secretary; Captain Hudson, chief inspector of the company on the Amazon; Captain Alfredo Costa, commander of one of the company's steamers; Mr. Mutter, Brazilian Vice-Consul in Glasgow; Mr. Russell and Mr. Rodger, partners of the firm; Mr. John Rankin, Mr. Archibald Russell, Mr. Pollock, superintendent of the Amazon Company; Mr. Ogden, resident surveyor, &c.; Miss Hudson, Mrs. Russell, Mrs. Rodger, and Mrs. Withered.

THE TRADE WITH THE UNITED STATES IN BRITISH AND FOREIGN SHIPS.

BEFORE the American Civil War the carrying trade between Great Britain and the United States was largely held by the Americans, who at that time possessed the finest fleet of clippers in the world for the rapid transit of cargoes.

In 1860 the United States had no less than two and a half million tons registered for foreign trade as against four and a half million tons by the United Kingdom for this purpose. So much, however, has the foreign carrying tonnage of the United States diminished during the last twenty-seven years, that she had only just over a million tons for the foreign trade while the United Kingdom had ships whose carrying capacity beyond the seas exceeded seven and a quarter millions, and the British Empire, including the United Kingdom, had over nine million tons.

The following table gives a few interesting particulars founded upon a return issued by the Board of Trade as to the tonnage of shipping entered and cleared in the United Kingdom in the trade with the United States during certain years from 1853 to 1887, viz:—

	British Ships.	United States Ships.	Ships of other countries.	TOTAL.
1853.....	857,250	1,592,939	91,199	2,541,388
1860.....	945,668	2,245,234	165,712	3,356,614
1865.....	1,231,660	484,098	152,692	1,868,450
1870.....	2,625,991	826,692	287,282	3,739,965
1880.....	6,939,245	612,634	1,441,952	8,993,831
1887.....	7,369,726	253,762	581,811	8,205,299

It will be noticed that British ships have almost monopolised the carrying trade with the United States which, in 1860, was mostly held by the Americans. The protection tariff of the United States has for a long period made it practically impossible for American shipowners to compete with Great Britain in the trans-oceanic carrying trade. On the other hand the navigation laws of the Union restrict the lake and coasting trade to ships of American construction. Hence the reason why the tonnage of the lake and river steamers of the United States is about treble that of its foreign tonnage.

LIFEBOAT COMPETITION AT SEA.—The necessity of having the safest possible lifeboats is beyond dispute. No plan of proving which are really the best boats can possibly equal the one adopted by the Council of the Life-Saving Appliances Exhibition at the Alexandra Palace, which is to have a practical competitive trial in a rough sea under the actual conditions of service. For this purpose they will give prizes and solicit subscriptions, so as to induce the largest possible number of entries. The proprietors of "Cherry Blossom" have generously headed the list with a donation of £75, and other philanthropic persons have sent smaller amounts. The trustees of this fund are Col. H. Mussenden Leathes, Doverecourt, Essex, and Capt. W. Darley, late nautical assessor to the Board of Trade, 48, Glenister Road, Greenwich. Subscriptions may be sent to either of these gentlemen, or to the managing director, Life-Saving Appliances Exhibition, Alexandra Palace, London, N. The trial should be very interesting and instructive, and the appeal will no doubt be liberally responded to.

LAUNCH OF THE CITY OF PARIS.

ON October 23rd Messrs. J. & G. Thomson launched from their shipbuilding yard on the Clyde a twin-screw steamer for the Inman and International Steamship Company, and intended for the Atlantic passenger trade. The vessel, which was named the *City of Paris* by Lady Campbell of Blythswood, is similar in every respect to the *City of New York*, fully described in our April Number, launched in March last by the same firm for the Inman Company. The *City of Paris* is 560 ft. in length over all, and 525 ft. on water line; 63 ft. 3 in. in breadth; and 42 ft. in depth (moulded); with gross measurement of 10,500 tons. She has been built on very fine lines, and, with her clipper bow in place of the more customary straight stem, the vessel has a graceful and majestic appearance. The ship will be propelled by two sets of triple-expansion engines, fed from nine boilers with 72 furnaces. The H.P. to be developed is 18,000, and, as already stated, she has twin screws, so that if one becomes disabled the other is available. Almost all the castings for the engines are of steel, and the moving parts have been made of the strongest yet lightest material. The machinery will be placed in two separate compartments, a water-tight bulkhead running longitudinally, dividing the port from the starboard engines. The boilers are in three separate compartments, and the whole motive power of the vessel is therefore divided into five compartments, so that should a collision occur, and the fracture in the ship's side be at the bulkhead, resulting in two compartments being flooded, there would still be at least one engine and one set of boilers available to propel her at four-fifths of her maximum speed. There are in all 37 auxiliary engines in the steamer, and these will be worked independently of the main machinery. The vessel has two bottoms, and the whole structure is divided by bulkheads or transverse partitions into fifteen separate water-tight compartments. This principle of complete subdivision has been more fully developed in these two vessels than in any other passenger ship now afloat. In this case there are no doorways, passage being only obtained from the upper deck. It is a new departure, and has been adopted to still further ensure the safety of the ship at sea. There are five decks. On the highest or promenade deck, which extends from end to end, there is a long house, with 25 passenger-rooms, the best on the vessel. The upper deck extends four-fifths of the length of the craft, and on it is a house containing the principal public rooms—dining saloon, smoking room, &c.—and about 30 superior state rooms. On the main and lower decks there is accommodation for first and second class passengers, the former being berthed in the centre. The orlop deck will be used chiefly for cargo. All the state rooms and other accommodation will be furnished on an elaborate scale, and altogether upwards of 2,000 persons can be accommodated. The vessel will be lighted throughout with electricity, over 1,000 incandescent lamps being provided. The *City of Paris* will be supplied with 22 lifeboats. With regard to the steering gear, the rudder, instead of being of the ordinary make, is of a style designed by the builders themselves, and has already been successfully applied to warships. The vessel has been specially arranged as an armed cruiser, and with her anticipated high speed and improved turning power she should prove a formidable cruiser. The ship will have three funnels and three masts, the foremast only being square-rigged.

At the launch there was a great concourse of spectators, who raised an enthusiastic cheer as the vessel moved slowly down the ways. After the launch a large company of guests met at luncheon in the model-room of Messrs. Thomson's yard buildings. Mr. George P. Thomson presided, and among those present were Sir Archibald Campbell, M.P., of Blythswood, and Lady Campbell, Mr. and Mrs. Edmund Taylor, Mr. James Spence and the Misses Spence, Lord Frederick Hamilton, and Professors Story and Jenkins. After luncheon the chairman gave the toast of "Success to the *City of Paris* and the Inman and International Company," and in doing so referred to the similarity of the *City of New York* and *City of Paris*. With regard to the performances of the former vessel on the Atlantic, he said that so far as the comfort afforded to passengers and seaworthiness were concerned she had already made a good name for herself. Those acquainted with the machinery of such vessels knew that they could not get up their top speed at once, but what the vessel had done in her last voyage showed that what they had expected her ultimately to accomplish would yet be fully realised. He hoped the enterprise of the Inman Company and the careful way they studied the comfort and safety of passengers would meet with full reward.

Mr. Edmund Taylor, director of the Inman Company, in responding, said he wished to remind those who expected that on her first or second voyage the *City of New York* would dash off like an express train, that that was not the way steamers were run. If it was wished to run them for profit, they must be run at first so as not to injure the engines. He acknowledged indebtedness to Messrs. Thomson for assisting them in every respect as regards both safety, comfort, and speed, and was convinced the vessels would prove themselves worthy of being classed among the first favourites in the world. The Atlantic traffic was increasing year by year, and his own impression was that it was little more than starting.

The *City of Paris* is now in the private dock of the builders, where her machinery, &c., will be placed on board by a new pair of sheer legs, which are said to be the largest yet constructed.

THE FASTEST TRANSATLANTIC VOYAGE IN THE WORLD.

THE intense interest which has been taken, both by the public generally as well as by the shipping community, in fast oceanic voyages has been greatly increased by the two splended runs of the *Etruria* from Queenstown to Sandy Hook during the last five months, in which she has twice broken the record for speed between Ireland and New York.

The time taken in the former voyage was 6 days 1 hour and 55 minutes, and in the latter 6 days 1 hour and 50 minutes. A greater distance to the extent of 58 knots was, however, traversed on the voyage from the 27th of May to the 3rd of June than in the one made from September 16th to September 22nd. The following table indicates the daily runs made on both voyages, viz.:—

	May 27th to June 3rd.	Sept. 16th to Sept. 22nd.
First day	455	437
Second day	458	465
Third day	496	456
Fourth day	485	490
Fifth day	503	490
Sixth day	457	458
	2,854	2,796

The former of these voyages was made with more favourable winds than the latter; hence the reason why two marvellous runs were made during two days in the summer passage. The day when the *Etruria* made 503 knots in June she had a fine breeze from the east, and put up sail, which apparently increased her speed. These two voyages of the celebrated Cunarder are the fastest in the history of ocean travelling. The passage in September would have been half an hour less if the steamer had not been kept waiting unduly for a pilot. Not only did the *Etruria* beat the record this voyage between Queenstown and Sandy Hook, but brought her passengers to the dock two hours earlier than on any previous passage.

The passengers were so intensely interested in the daily runs made during this voyage that almost all of them kept a log. This ocean speed record-breaking steamer carried, on the voyage in question, no less than 567 cabin passengers; and so pleased were they, says the *New York Sun*, for "having smashed the record of ocean speed, that they smiled for hours afterwards, as they told how their trip had been the fastest that any ship had ever made in the long stretch of nearly 3,000 miles from Queenstown to Sandy Hook."

Experts on ocean speed regard the two runs we have notified of the *Etruria* as a strong indication that this steamer may, before long, perform the voyage between these places in an even six days; and that, probably, some new ship will be built to make this passage in less than six days.

We have reason to believe, not only that this supposition will soon be realised by a few steamers possessed by British companies, but by three or more foreign companies.

The General Transatlantic Company are now building a new twin-screw steamer at St. Nazaire, which will be ready for passenger traffic across the Atlantic next year. This ship will, it is said, greatly exceed in speed the celebrated four liners they now possess, running between Havre and New York, and which have made voyages between these ports almost as quickly, in proportion to the distance, as the *Umbria* and *Etruria*.

A few enthusiasts as regards ocean speed, including Sir William Pearce, have expressed their opinion that the time for crossing between Queenstown and Sandy Hook may be reduced to about five days, and that steamers built for this purpose would be remunerative to their owners, notwithstanding the great additional amount of fuel that would be consumed to attain this end. The majority of the shipping community, however, appear to think that the disinclination of the voyaging public to make passages by Transatlantic five-dayers, as those advocated new steamers may be called, would be as great, if not greater than the opposition which was recently manifested against what many persons called the reckless railway races between London and Edinburgh, last August, by the 10 a.m. "express" of the London and North Western and Great Northern Railway Companies.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from September 25th to October 24th, 1888:—

Aborn, George, engineer to the *Vernon*, additional, to date October 13th.
Adams, John H., chief engineer to the *Asia*, additional, to date October 1st.
Apps, W. R., engineer to the *Alecto*, to date October 23rd.
Basson, Harry, acting assistant engineer to the *Penelope*, to date October 23rd.
Bevan, William J., engineer to the *Urgent*, additional, to date September 27th.
Burner, William H., staff engineer to the *Vernon*, additional, to date October 13th.
Castle, William, inspector of machinery to the *Hibernia*, additional, to date September 27th.
Gibson-Sugars, J. S., assistant engineer to the *Arethusa*, to date October 10th.
Hockey, Stephen, engineer to the *Cockatrice*, to date October 10th.
Houghton, Sidney A., assistant engineer to the *Victor Emanuel*, additional, to date October 19th.
Liversedge, Henry T., engineer to the *Watchful*, to date October 8th.
Meiklejohn, H. J., acting assistant engineer to the *Anson*, to date October 16th.
Moore, Francis J., chief engineer to the *Excellent*, additional, to date September 29th.
Morgan, John T., fleet-engineer to the *Penelope*, to date October 23rd.
Ross, George J., chief engineer to the *Gannet*, when re-commissioned, undated.
Ryan, William, assistant engineer to the *Marathon*, to date October 16th.
Spry, F. M. D., assistant engineer to the *Medusa*, to date October 16th.
Stuttaford, Frank R., assistant engineer to the *Penelope*, to date October 23rd.
Steward, C. H., engineer to the *Vernon*, to date October 13th.
Trubshaw, Richard H., fleet-engineer to the *Hibernia*, additional, to date September 29th.
Wood, Alfred, inspector of machinery to the *Pembroke*, additional, for service as chief engineer to Chatham Dockyard, to date October 1st.

HOAR & BROWN'S HARDWOOD MARKET REPORT, 23rd October, 1888.

TEAK.—The deliveries for the four weeks ending 19th October were 778 loads, and the total for the nine months 12,545 loads, as against 7,633 loads in 1887 and 8,394 loads in 1886.

The stock of teak logs in London, at the end of September, was 6,508 loads, against 11,316 loads in 1887, and 11,597 loads in 1886.

The market, therefore, is in a most healthy condition. The stock is small, with no prospect of it being materially increased, as most of the cargoes afloat are disposed of, and, with perhaps one or two exceptions, will not come to our market.

We also learn that large sales have been made forward at advanced prices.

Another very encouraging feature is that nearly all the old stock which served to keep prices low has now been sold. This fact in itself will considerably assist an upward tendency.

Shipbuilding has been unusually brisk, and several cargoes have been placed for this purpose. Other inquiries for cargoes are abroad, and will have to be filled, doubtless leaving the market in a still firmer position. In addition some Government orders are expected shortly, and when these are placed there will be a very small stock from which to execute them.

The rolling stock manufacturers are still fairly busy, and in two cases some large business has been contracted for.

MAHOGANY, HONDURAS AND MEXICAN.—We have to report a firm market in this article, although several cargoes have arrived during the month which looked rather disquieting. The demand, however, has increased, resulting in some large sales, and prices are again very steady.

There is promise of a very fair inquiry for some time, and we hear of several contracts which are likely to take up a considerable quantity of wood and thus give the market a further lift.

Cuba has had a quiet time during the last month, and the demand for the future has no appearance of any great change. The stocks are heavy, and prices show rather a downward tendency, which would no doubt be increased should holders endeavour to force sales.

CEDAR.—This wood is showing a marked improvement, parcels of inferior quality having realized 10 per cent. in excess of last month's prices, and good quality as much as 20 per cent.

GREENHEART.—There is little stock here to deal with, but inquiries are plentiful. Cargoes are now changing hands at very advanced prices.

AMERICAN WHITEWOOD AND WALNUT has been going well, and most of the old stocks are cleared off the market.

INDUSTRIAL NOTES.

CLYDE AND EAST OF SCOTLAND.

THE condition of trade on the Clyde and in the whole of the West of Scotland has continued brisk throughout the month. Since the 1st of October till the present date (27th inst.), quite a large number of vessels—principally steamers—of heavy tonnage have been launched from the different shipyards located on the Clydeside, and the returns for the month cannot be other than large; probably much heavier than those for October of 1887.

Considerably over 200,000 tons of new work have been completed in the Clyde yards since the 1st January last, *i.e.*, inside of ten months. The significance of this remark is seen when I state, that the entire output for last year was only about 185,000 tons, and that for 1886 less than 173,000 tons.

The largest vessel included in the past month's output is the *City of Paris*, sister ship to the *City of New York*, built by Messrs. Thomson, Clydebank, for the Inman Line; and the next largest, the *Peninsular*, constructed by Messrs. Caird & Co., Greenock, for the Peninsular and Oriental Company. The former has a tonnage of no less than 10,500 tons—being, therefore, one of the biggest steamers afloat—and the last-named is 5,500 tons.

Inquiries have not, it is worth observing, been nearly so numerous as in the two preceding months, during which orders for vessels having an aggregate tonnage of about 100,000 tons gross were placed with Clyde builders. One thing is noticeable, and that is, that such orders as have been booked during the past few weeks have nearly all gone to firms whose yards are located on the lower reaches of the river. Messrs. Scott & Co., Greenock, have secured an order for a 2,500-ton steamer, to be engaged in the China trade; Messrs. D. J. Dunlop & Co., Port Glasgow, have contracted to build a steamer of 900 tons for the Bristol Channel service; while another Port Glasgow firm, viz., Messrs. Hamilton & Co., have arranged to construct for a London firm a steel sailing ship of 1,800 tons net register. One fairly good order has come to the Glasgow end of the river, Messrs. Napier, Shanks & Bell, Yoker (who have not been busy for some time), having obtained from a London firm of shipowners an order for a sailing ship of fully 2,000 tons register.

The brisk state of the shipbuilding trade has, as might be expected, favourably affected the kindred industries, *e.g.*, steel and iron manufactures, and the leading Scotch firms have each enough orders to keep them busy till the end of the year.

The prices of all classes of shipping material remain firm, the tendency being to harden; while really good, in one or two instances unusually high, freights have been obtained for goods for long-distance voyages.

Some really pertinent observations on the present activity in the shipbuilding trade is contained in the report read at the third annual meeting of the Scottish Shipping Investors' Protection Association, held in Glasgow on the 11th October. The directors state that while there are prospects of profits being realized by shipping investors, there are not wanting indications of a tendency to a renewal in over-building, which has already caused such havoc with the shipping trade, and express the hope that shareholders who have suffered so heavily in the past from the over-production of tonnage and consequent depression of freights will use their influence to keep the supply sufficiently near the line of demand to insure the continuance of profitable employment of the vessels already afloat. One of the main reasons for the institution of this body was to secure a better arrangement between shipowners and ships' managers, and the report states that there is evidence from many sources that during its existence the influence of the association has been a large factor in bringing about a more satisfactory understanding between those who put their capital into ships and those who are their caretakers and managers.

A good many ships' sales have taken place during the month, and such vessels as have changed hands have done so at considerable advantage to the seller, the prices obtained being generally considerably higher than could have been secured six months ago.

Some pretty good marine contracts again fall to be recorded this month. These include an order placed with Mr. James Ritchie, Hope Street (on behalf of his principals, Messrs. John Brown & Co., Sheffield), for the crank and propeller shafting for two twin-screw colonial steamers, a-building at Messrs. Thomson's yard at Clydebank. Also an order for a set of quadruple-expansion engines of 1,000 I.H.P., secured by Messrs. Rankin & Blackmore, of Greenock, for a steel screw steamer now on the stocks of Messrs. Robert Duncan & Co.'s yard at Port Glasgow.

The 23rd October was a notable day in shipbuilding circles here from the circumstance that three vessels—two steamers and a sailing ship—having an aggregate tonnage of nearly 16,000 tons, were launched that day from Clyde yards.

I note among the "Lanarkshire wills" registered lately that of the late Mr. John Inglis, of Messrs. A. & J. Inglis, shipbuilders, Pointhouse, who has left a fortune of over £261,000; so that shipbuilding does appear after all to be a paying spec.

Mr. J. W. Shepherd, who retired from the management of the Fairfield Shipbuilding Company, has, I learn, just been appointed general manager to the London and Glasgow Shipbuilding Company in room of Mr. D. Kinghorn, resigned. Mr. Kinghorn held the appointment during all the time the company has been in existence, a period of some twenty-four years.

As many as 384 vessels, of over 371,000 tons, arrived in the Clyde from foreign ports during the quarter ending 30th September. This shows a substantial increase over the arrivals in the preceding quarter, but a slight decrease when compared with the figures for the corresponding period of 1887.

Mr. White, the new manager at Fairfield, is, I hear, to have a seat at the Managing Board of Directors.

Over 38,000 emigrants left the Clyde for places out of Europe during the nine months ending 30th September last.

As showing the rapidity with which the Greenock stevedores do their work, I may state that on one day recently a vessel which arrived at the James Watt Dock with 2,400 tons of spoolwood was discharged in the short space of 39 consecutive hours.

The Clyde Navigation Trustees, who have for two years been engaged in constructing a new dock of goodly dimensions on the south side of the harbour, near Govan, have resolved to erect another dock near the same spot. The new erection is estimated to cost £270,000, and it will take three years to build it.

Messrs. Alexander Findlay & Co. have just had built for them at Motherwell—twelve miles from Glasgow, a new engineering and bridge-building establishment. The erection consists of a main central shed, 270 ft. in length by 54 ft. wide, and minor buildings. A start is expected to be made in the course of the next few weeks.

It is hinted by those who know, that the leading Scotch iron-masters are arranging to form themselves into a syndicate for regulating the production and prices of material.

Messrs. Clark & Co. contemplate making a considerable addition to their already extensive thread works at Paisley. Messrs. Arrol, bridge contractors, Glasgow, the volume of whose business also continues to press forward, will probably have to add to their premises at no far distant date. The great contract which this firm are just now engaged in executing, viz., the construction of a bridge across the River Forth at Queensferry, continues to make satisfactory progress towards completion. I find, from the latest report issued, that 52,000 tons of steel have been used in connection with the work up till date, and that close on 600,000 cubic feet of granite have been set.

The men employed in the coal mines in the Lanarkshire district (which includes Glasgow) have recently been granted an increase of 2½ per cent. in their wages, though it is evident from the proceedings at a recent meeting that the men are not satisfied with this small advance, and they will not improbably "agitate" shortly for a further increase. Meanwhile, the price of the "black diamonds" tends to move upward.

The Channel Fleet paid a short visit to the Clyde towards the end of the month. The "fleet," it is worth noting, was on the present occasion "coaled" by a Slamannan (Scotch) firm, the (apparent) result of a correspondence between representatives of the Scotch coal-masters and the Lords of the Admiralty, in which the former complained of being "Boycotted" in this respect. All's well that ends well.

The "setting" of the affairs of the Greenock Harbour Trust "in order" is reported to have cost £6,242, of which £5,145 was claimed by the Bondholders' Committee "for travelling expenses and for services rendered during the past eighteen months."

A small but thriving concern is the Irvine Harbour Trustees, who, since 1884, have, after meeting all their expenses, realised over £1,000 a year.

Arrangements are being made in Glasgow for the establishment there of an Amalgamated Hammermen's Trade Association.

The annual accounts of the Leith Dock Commission, just printed, show a surplus in the income over the expenditure of £38,000. Good business that!

That busy little shipping port, Grangemouth, is pressing for increased harbour accommodation. The leading shipowners and traders of that town, at a recent meeting, "resolved," to ask the Caledonian Railway Company to provide an improved entrance "of sufficient depth to admit the larger classes of vessels."

North of Scotland.—Trade in the north has continued in a fairly active state throughout the month. At Dundee and Aberdeen a good deal has been done in the way of shipbuilding, and several new vessels have recently left the ways at both ports, though but few fresh orders for work of this kind have been obtained by local firms for some little time back.

I have to report the failure of a shipowner, viz., Mr. James Aitken, jun., who was examined in bankruptcy at Aberdeen on the 9th October. His "statement of affairs" showed a deficiency of over £8,000.

The sum of £5,750 was obtained for a spinning-mill which was sold by auction at Dundee a few days since.

A Technical Institute was opened at Dundee on the 15th October. The Institute has been built and partially endowed by the late Sir David Baxter, whose benefactions to that town are so widely known and appreciated.

Arbroath shipping does not seem to have been in a very prosperous state of late. The revenue for the year ending 14th October amounted to rather less than £3,000, which is less by fully £500 than the receipts for the previous year.

A strike for an increase in wages occurred among the Dundee shipyard workers on the 17th inst., but ended the following day by the employers conceding a small advance.

Substantial progress has been made in the construction of a new harbour at Portknockie, which was begun about fifteen months ago. A breakwater of 340 ft. in length has been erected, and every effort is being made to push the work forward. Portknockie is situated on the Banffshire coast, and the undertaking, when completed, will be found of great advantage to the residenters—principally fishermen—of that district.

Board of Trade Examination of Marine Engineers.—At the examination of marine engineers held at North Shields from 9th to 13th October, the following candidates passed their examination for *extra* first-class engineers:—Mr. T. Carlton, of Barrow, and Messrs. T. W. Wray and F. Pitt, of Gateshead. They were prepared by Mr. W. H. Thorn, 5, Waterville Terrace, North Shields. It may be stated that only five candidates passed this examination throughout the kingdom, and that the other two were prepared for examination by Mr. T. Dewar, of 721, Commercial Road, E.

TRADE NOTES FROM THE TYNE, WEAR, HARTLEPOOLS, &c.

The Tyne.—During October several important additions have been made to the order books of Tyne shipbuilders, and the signs of high-pressure activity are on every hand apparent. Some builders, indeed, find it inexpedient to negotiate for further contracts, unless in cases where considerable latitude as to date of delivery can be allowed. The principal obstruction to business which can now be said to exist is still to be found in the difficulty of obtaining steel material from the manufacturers, and at many establishments the commencement of frame turning for vessels has been delayed for weeks through this circumstance. The supply of labour is also deficient, and this is, of course, an additional hindrance to the progress of operations. Despite the existence of these impediments to quick production, however, vessels are being launched with great frequency, and there is reason to expect that the aggregate output of tonnage for the year will equal, if not exceed, the highest records in former busy periods. Since the commencement of the present briskness the operatives have had one advance of wages, and they have now given the employers an informal notice that they will shortly put in a claim for a second advance. The hint thus given will doubtless cause shipbuilders to exhibit greater hesitancy in negotiating for new contracts, and until this matter is disposed of, it may be taken for granted that very little additional tonnage will be placed for building in this or any other district of the North East Coast. With reference to such leading firms as Messrs. Armstrong, Mitchell & Co., Messrs. Hawthorn, Leslie & Co., Messrs. Palmer and Co., Messrs. Swan & Hunter, and the Tyne Shipbuilding Company, there is nothing to be said, excepting that in every case when vessels are launched, the berths are immediately occupied with the keels for others. Messrs. Schlesinger, Davis and Co. are about to enlarge their yard by the addition of an extensive piece of ground in the immediate vicinity. It it understood that one or two more building berths will be formed, and that some additional plant of an improved type will be put down. Messrs. Wood & Skinner have four good-sized vessels on the stocks, and are carrying out extensive repairs to a vessel lying beside the yard. Should trade continue good, this firm will also probably find it expedient to extend their premises, and should such a course at any time be deemed desirable, there is plenty of unused ground adjoining their yard, which will be available for the purpose. The Tyne Commercial Dry Dock Company are making fair progress with the construction of their graving dock at Jarrow, which, when completed, will be one of the largest in the kingdom. The Tyne Pontoon and Dry Docks Company are kept pretty busy with repair work. Among other steamers lately overhauled by them were the *Albertino* and the *Hector*. The s.s. *Lady Bertha*, which has met with injury on the coast of Iceland, will undergo a thorough overhaul by this Company, on her return to the Tyne. The extraordinary activity in the marine engineering establishments, shows no signs of abatement, but is, on the contrary, becoming even more marked. In the foundries, which are devoted to the production of marine castings, the same unprecedented briskness exists, and the chief difficulty employers have to deal with is, the impossibility of getting operative moulders in sufficient numbers to carry on the work in a way that will satisfy the requirements of customers. The forges in which engine shafting, ships' keels, stern frames, and rudders are produced, are literally "packed" with work, and the proprietors of these establishments find it exceedingly difficult to effect delivery in accordance with contract conditions. Steam winch factories are also as busy as could be wished, and makers of other engineering specialities are generally doing well. Manufacturers of steel plates as well as steel castings have forward contracts which will keep them fully engaged for months to come, and in the finished iron works operations are now kept going steadily. Prices of both steel and iron are tending upwards, and consumers will probably have to pay much higher prices than those now current before the end of the year. Chain and anchor works are now very busy, and enquiries for steamers' outfits are pretty numerous. No less than 200 tons of Tyzack's patent anchors are being manufactured at Messrs. Abbot's works, Gateshead, and Messrs. Spencer, of Newburn, have also an immense quantity of Wasteney Smith's anchors in hand. Bolt and rivet works are sharing to a very full extent in the activity observable in kindred industries. Manufacturers of electric lighting apparatus are well provided with orders.

The Wear.—Among other shipbuilding orders recently placed in this district, are two from local owners for vessels of exceptionally large tonnage. Inquiries from the great centres of British shipping, as well as from foreign sources, continue to come to hand pretty freely, but most of the builders have so much work to deal with that they are somewhat reluctant to enter into negotiations for new contracts. Messrs. J. L. Thompson & Sons have acquired a piece of ground in contiguity to their already very extensive establishment, and arrangements are now in progress to incorporate it with their present premises. It is understood that they intend to utilize this new ground, when properly levelled and prepared, for frame turning and adjusting purposes. The firm have applied to the local authorities for permission to build a footbridge over a roadway which separates the new ground from the present yard, and this permission will no doubt in due course be granted. The Strand Shipbuilding Company, who, for a long time past, have had only one building berth occupied, have now a second keel laid down, and the yard is consequently about to become much busier than it has been for some years past. Messrs. Blumer & Co.'s yard is also assuming an air of briskness which has not been witnessed there for many years. The Sunderland Shipbuilding Company, having been successful in securing most of the foreign orders for which they submitted estimates, are now energetically proceeding with their execution. The company have further developed the system of rivetting by pneumatic power supplied to them early in the year by Messrs. de Bergue and Co, Manchester, and in the present busy time they are finding the system a very efficient aid to quick and economical production. At Mr. Laing's yard the plating of the large vessel ordered by the British India Steam Navigation Company has been commenced, and in such parts of the shell as are free from curves, the plating is being put on in 28 ft. lengths. A line of rails is being laid at each side of the keel to facilitate the placing in position of these unprecedentedly heavy plates. Messrs. R. Thompson & Sons have put down a third keel in their yard at Southwick, and the vessel for which it is intended is, like the two already in progress, of very large tonnage. At the time of writing the firm are preparing to launch a really first-rate cargo boat which has been ordered by the owners of the s.s. *Drumbarlie*, launched by the same builders about six months ago. Messrs. Short Brothers have begun to use for framing purposes the pattern of angle bar which combines frame and reverse bar in one, and which is now coming into use in all the larger establishments. This type of frame is, of course, only adapted to cellular-bottomed vessels, in which the full frame consists of three pieces. Messrs. Doxford launched late in the month a vessel named the *Hamburgh*, which is to be registered at the port of Gotebörg. The firm have three other boats on the stocks, and have also one to put down in the berth just vacated. Greatly increased activity is to be noted at all the remaining establishments. The New Scotia Engine Works may now be said to have actually commenced operations, although, as a matter of course, only a very few hands have yet been engaged. The firm, however, have a good number of orders booked, and in a very short time the place will be in full swing. The Palmer's Hill Works continue extremely busy, and the same remark applies to the North Eastern Engine Works, as also to Messrs. Doxford's and Messrs. Clark's Works. At the last-named establishment the two largest and most powerful sets of triple-expansion engines yet ordered on the Wear are now in course of manufacture. Mr. A. A. Rickaby's Works are kept in steady operation on orders for piston packing and other specialities. The Pier Engine Works Company are carrying out extensive repairs to the engines of a locally-owned steamer, the hull of which is to be repaired by Mr. John Wigham on his slipway at Hylton. Messrs. C. & M. Douglass' Bedford Street Engine Works have been well employed on repair contracts until quite recently, when a lull set in. The firm are arranging for other contracts, however, and in a short time the briskness usually seen at this establishment will be restored. The type of gas engine manufactured by Messrs. Ridealgh & Fairman is rapidly gaining in public estimation, and the firm are receiving as many orders as they can conveniently deal with. They contemplate bringing out, at a low price, a smaller gas engine than has yet been manufactured, and for this speciality a large sale is anticipated. Messrs. John Lynn & Co., Messrs. Welford Brothers, and other makers of steam winches and steering gears, continue in full activity. In the forges, the pressure of work was never greater, and both brass and iron foundries show an equal state of briskness. The new patent anchor, lately brought out by Messrs. Byers & Storey, has been recently tested on the trial trip of the steamer *Cyrene*, built by Messrs. Short Brothers, and it is said to have shown unusually good holding power.

The Hartlepools.—The visit to East and West Hartlepool of the North-east Coast Institution of Engineers and Shipbuilders on Saturday, the 20th inst., was looked upon as an event of great interest by the inhabitants of those important centres. The members of the Institution were received on their arrival at East Hartlepool by a reception committee, representative of the industrial life of the district, and were afterwards shown through the principal shipbuilding and engineering establishments. A banquet in the evening brought a most interesting day's proceedings to a close. In the new central shipyard, belonging to Messrs. W. Gray & Co., the laying out of which was only commenced in January this year, there are now three of the largest-sized vessels on the stocks, and frame-turning for a fourth is being proceeded with. The first launch from this new yard will take place in two or three weeks from now. In the West Hartlepool shipyard, belonging to the same firm, there are six vessels in progress, and frame-turning is carried on night and day. Messrs. H. Withey & Co. have four large vessels in hand, and Messrs. Irvine & Co. are well provided with work. The Marine Engine Works continue to show extraordinary briskness, and at the Central Works, which is one of the largest engineering establishments in the North, it has been found necessary to commence extensions to several departments. Among other additions being made to the productive resources, is a new forge for the manufacture of ships' stern frames, keels, rudders, and engine shafting. Considerable extensions are also being carried out at the West Hartlepool Iron and Steel Works, and when the additional buildings are completed it is estimated that the weekly output of plates will reach 1,400 tons. Rope works and cement works are kept very busy, and in the timber yards and saw mills there is a large business doing.

The Tees.—The three shipbuilding yards at Stockton are now very busy, all berths being filled, excepting where alterations are in progress that prevent occupation for the present. Messrs. Blair & Co. have as many orders for marine engines as any engineering firm in the North, but their excellent productive facilities enable them to pretty well keep pace with the reequirements of customers. The works of Messrs. Head, Wrightson and Co. are very fully employed, and at the Stockton Forge Company's establishment the state of business in most satisfactory. Messrs. Riley Brothers are greatly pressed with orders for their special types of boilers, and Messrs. Rogers & Co. are busily engaged on orders for steam winches, steam steering gears, &c. In the state of work at the local rolling mills an improvement of the most pronounced kind has taken place since the beginning of the year, and at some establishments present appearances rather vividly recall the scenes that were witnessed in the palmy days of the industry. In the Middlesbrough shipyards a prosperous condition of business is also apparent. Messrs. Raylton, Dixon & Co. have all the building berths in their "old yard" occupied, and will very shortly be in a position to fully utilize the building accommodation of the new yard recently leased by them from the Tees Side Engine and Ironworks Company. Messrs. Westgarth and English are very busy on contracts for marine engines and boilers, to be supplied to vessels building in the locality. The fitters and other workmen at Messrs. Bolckow, Vaughan & Co.'s works came out on strike about the middle of the month for an advance of ten per cent. on the wages rate. The boilersmiths and moulders have since accepted an advance of 5 per cent., and have returned to work, but in the case of the fitters no settlement has been arrived at. A strike of the blast furnace men in the employment of Messrs. Wilsons, Pease & Co., is also apprehended, but in this case it is not an advance of wages which is demanded, but the dismissal of a workman who is said to have declined to join the Operatives Trade Union. The iron foundries and bridge works continue to be satisfactorily employed, and at the different steel works the pressure of business appears to be greater than ever. The shipments of pig iron continue to be very satisfactory.

THE MERSEY.

THERE is no doubt that Liverpool shipbuilders are the only ones in the trade who are not full up with orders. Messrs. Laird Brothers' yard is the sole exception to this rule, and there activity prevails in all departments. Meanwhile orders still continue to be given by local shipowners to outside yards. The Naval Construction and Armaments Company, of Barrow-on-Furness, have secured an order for two steamers for the West Coast trade, of the Pacific Company of Liverpool. This makes four steamers now in course of construction for the Pacific Company by the same builders. Messrs. Laird Brothers have hitherto always had a fair share of the Pacific Company's business, but no doubt this firm being fairly full up has had something to do with the fact of the Pacific Company passing them with the last batch of orders. Messrs. Hamilton, Fraser & Co., the managing owners of the "Inch" line of steamers, have just ordered two steamers,—one from Messrs. Palmer & Co., Limited, and the other from Messrs. Thompson, of Sunderland. It does seem a pity to the Liverpool community that so much of our own business should have to go elsewhere.

There is every reason to believe that, although a very large number of orders have been issued lately, the demand is beginning to fall off. This is very largely occasioned by the higher prices now demanded by shipbuilders. It really is something to be thankful for that shipbuilding is receiving a bit of a check, as it seemed as though all the errors that were committed during the "boom" of 1879-83 were to be repeated.

Freights have continued to improve in all directions, and jubilation and song reign supreme. From Calcutta 60s. per ton has been paid for jute to Dundee for charter, and we have even heard of room being relet in a chartered boat at 80s. per ton. These figures are prodigious. Bombay has remained steady; 27s. 6d. to 30s. has been paid; and, although, for the moment, there seems no indication of a further rise from this port, still the market is so firm all round, that higher rates must ultimately be paid. We have so continually referred to the evils of "fixing ahead," that it was with pleasure we read a very able article in our respected contemporary, *Fairplay*, under date of 19th October, in which the writer illustrates the correctness of our views. No doubt the policy of fixing ahead, though dangerous to the collective interests of shipowners generally, has more or less *seemed* to pay the greedy individual owner in the past; but the truth is, the benefit was more apparent than real. There is a great deal of human nature about man, and a great deal of vanity about the "managing owner," so that the "astute," the "far-seeing" manager, who had discounted the future, in most cases turned round, after he had fixed, and joined the common enemy, with the view of depressing the market, thus showing to his admiring shareholders what fortunate men they were to have their money under the care of such a manager. The result of this action was, that the market was quite swamped, and the "astute" one himself suffered in the rate that was procurable for his second voyage, and this through the very condition of things that he had so largely helped to create. There has been 120,000 tons of tonnage from Bombay alone, fixed ahead, up to May of 1889, and at rates varying from 18s. 9d. to 21s. 9d. These rates are far below what can be procured even now; and as there seems every probability of a still further rise, as the boats become more prompt, there is no doubt that a very costly lesson is in store for those owners whose steamers are included in the tonnage referred to. But to hark back again to the freight-market: all the Eastern rates have improved; charterers in those trades were the last to accept the inevitable; but now, all round, there is a very substantial improvement to record. The Madras coast is now offering 55s. per ton; only three months ago, one-half of this rate was all that was obtainable. Rice charterers are doing nothing just yet for next season; but they are already bidding much more money for tonnage, and even without success, and there is no doubt whatever that rice freights for the appoaching season will be very high. The keystone to the whole market is the Black Sea, and there freights have not only been thoroughly maintained, but have reached such a figure that a war-scare only was once thought to justify. Fleets of steamers have been loadod already in the different ports of the Black Sea; but the charterers there seem insatiable, and still cry out for more, and bid one against the other for tonnage in a manner almost reckless. Odessa is offering 36s. 3d. to a good port, and 2s. 6d. per ton more for Copenhagen. From the Danube, 7s. *per quarter* to Rouen is being bid for a prompt boat; this is equivalent to nearly 46s. per ton tallow. The Azoff is paying 43s. 6d. per ton to the Continent, and Batoum 30s. per ton of 20 cwt. to the United Kingdom or Continent.

American cotton freights have generally improved, the Gulf ports being exceptionally strong, 17-32 and 5 per cent. being the current rate for charter from Galveston to Liverpool, whilst on the berth the liners are getting 1-32 more. New Orleans is paying the same money. These rates are all for prompt

tonnage; but although backward boats are not worth the same, still the encouraging feature is, that the value of the steamers continues to improve as they become more prompt. The Northern ports, Norfolk, Newport News, Charleston, Savannah, &c., are, if anything, a trifle weaker, but nothing worth speaking of, and the accepted idea is that the slight pause will but be the forerunner of another jump.

The big salt syndicate will without doubt have a material effect on the outward freight market, as the higher prices obtainable for salt will naturally react on the freight for carrying same. The effect of the syndicate is already materially felt in the coasting trade, where the salt-merchants, being in a state of semi-panic and not knowing what figure salt will ultimately reach, are bidding frantically one against the other both for salt and tonnage. This, although only a straw, serves adequately to indicate the direction of the wind, and the weathercock points to higher freights to all salt ports; because the same anxiety that has been felt in local markets will be experienced abroad as soon as the important effects of the syndicate become to be thoroughly understood by the buyers. The natural effect of this will be felt not only in the salt freights, but, through them, on all other outward freight markets.

The two Manx companies, the old and the new, have at last amalgamated: there can be no doubt this is the wiser course to pursue. The pugilistic Kilkenny cats, we are informed, *did* manage to come out of the combat with a tail apiece, although that was all that was saved; but this result, although naturally unprofitable to the feline gentlemen chiefly concerned, would by comparison be eminently satisfactory, to the end that must ultimately have been the fate of the two companies if their suicidal struggle had been maintained and fought to a finish. As it is, everybody has cause to be pleased: the old company have bought off their persistent opponents, and will now no doubt restore their rates, at any rate partially; the shareholders in the new company come out practically without loss, although their shares were down as low as 7/6 for a 20/- share; and last, and by no means least, Sir William Pearce gets a good price for the boats that he built in bad times and with every expectation of a loss. It is an ill wind that blows no one good; but it is a far better gale that satisfies everybody concerned.

SWANSEA.

TRADE at the docks during the month has been below the average, although the export trade shows some improvement. Shippers continue to be much inconvenienced by the want of ready tonnage, and their rolling stock is loaded awaiting the arrivals of vessels. The demand for tonnage is exceptionally active, and rates of freight in all directions are very high. Tin plates are firm, with unchanged values. There is more inquiry from the Indian markets, and sellers find themselves able to secure ruling quotations. The metal market is quieter generally, and prices are unchanged after the advances which have taken place in most metals. A pause in activity must be looked for.

Cardiff.—Steam coal has been in good demand. The best qualities have made 11s. 3d.; secondary descriptions, 10s. 6d.; and best Monmouthshire, 9s. 6d. per ton. House coal has supported late rates. Patent fuel has continued firm. Furnace and foundry coke have made 14s. 6d. and 16s. 6d. respectively. The manufactured iron and steel trades still present an encouraging appearance.

BARROW-IN-FURNESS.

THERE has been a fuller sale of hematite pig iron, and the demand has strengthened as well on home as on foreign account. The business doing is chiefly confined to Bessemer qualities, the demand for forge and foundry descriptions being quiet and lifeless. As a consequence of this, the make of the district is almost wholly confined to Bessemer iron. Stocks are still comparatively small in the hands of makers, but a further increase is noted in the stock of hematite warrants. Steel-makers are much busier, and in all departments much activity is observable. It is probable that further extensions will soon be made in the Siemens-Martin plant in the district, as makers find it impossible to meet the very heavy demand which exists for plates and angles. The former are quoted at £7 15s. and the latter at £7 per ton. Rails are in brisk demand at £3 18s. 6d. for heavy sections. Shipbuilders and engineers are busier on receipt of new orders. Iron ore firm at 9s. 6d. to 12s. for ordinary qualities net at mines.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Oka.—On September 22nd there was launched from the Jarrow yard of Palmer's Shipbuilding and Iron Company, the steamship *Oka*, of the following dimensions:—Length, 347 ft.; breadth, 44 ft.; depth, 26 ft. 3 in. She is intended to carry petroleum in bulk, and has been designed and built under the supervision of Sir Edward Reed, and is the second of a fleet intended for this trade. The vessel is divided longitudinally and transversely into numerous oil-tight compartments, and special means have been fitted for working the cargo and insuring the vessel against accident. She is provided with a powerful steam steering gear, and is also supplied with a complete electric light installation, fitted in the most approved manner for working oil cargoes. The ship is supplied with machinery of the triple-expansion type, capable of developing fully 2,200 I.H.P., which will be sufficient to drive the vessel at a speed of 11½ knots when fully laden, and has bunker capacity of about 600 tons, the bunkers being also arranged to carry liquid fuel, if desired. The vessel and her machinery have been built under Lloyd's special survey.

Barmston.—On September 22nd there was launched from the shipbuilding yard of Messrs. S. P. Austin and Sons, Sunderland, a screw steamer, specially designed for the coal and general carrying trade, built to the order of the Lord-Lieutenant of Ireland. The vessel is constructed of Siemens-Martin steel, with cellular double bottom for water ballast throughout, with self-trimming hatchways, full forecastle, bridge-house, quarter-deck, and full poop, rigged as a fore-and-aft schooner, with iron lower masts. Her gross tonnage is about 1,450. Her machinery is constructed by Mr. G. Clark, of 160 N.H.P., with boilers to work at 160 lb. pressure. Her four steam winches and donkey boiler are by Welford Bros., Pallion, and her steam steering gear by Donkin and Nichol, Newcastle. She was named *Barmston* by Mrs. Eminson, of Seaham Harbour.

Bertha.—On September 22nd a sloop was launched from the yard of Mr. Henry Connell, ship and boat builder, Selby. The vessel, which has been built to the order of Messrs. M. Scott and Co., of the Providence Oil Mills, Selby, is oak built, and its dimensions are:—Length, 67 ft. over all; 16½ ft. beam, 10 ft. depth of hold under hatches, and is intended to ply between Hull and Selby in the seed trade. She was christened *Bertha* by Mrs. J. F. Watson, eldest daughter of Mr. Scott.

Iona.—On September 22nd a steam trawler was launched from the yard of Messrs. Cochrane, Cooper and Schofield, Grove Hill, Beverley. The vessel, which is the fourth of the class built for Messrs. Pickering and Haldane, smackowners, Hull, was named the *Iona*, which ceremony was performed by Miss Jameson. The dimensions are:—Length between perpendiculars, 100 ft.; beam, 20 ft. 3 in.; depth of hold, 11 ft. The vessel is fitted with all the latest improvements for trawling. The engines, 54 H.P., will be made and fitted by Messrs. C. D. Holmes and Co., of Hull, to whose order the vessel is built.

Elena Oms.—On September 24th there was launched from the yard of the Sunderland Shipbuilding Company, Limited, a finely modelled steel screw steamer, specially constructed for the passenger and fruit trade in Havana. The dimensions of the steamer are:—220 ft. by 31 ft. by 13 ft.; classed 100 A1 at Lloyd's, having poop, bridge, and topgallant forecastle. She is rigged as a two-masted schooner; the quickest and best arrangements are made for rapid loading and discharging, two steam winches being supplied by Messrs. Clarke, Chapman, Parsons & Co., of Gateshead, and windlass by Messrs. Harfield & Co. Upon the poop there is a large smoke-room, forming an entrance to the main saloon, which is fitted up to accommodate thirty-two first-class passengers, the officers and engineers being berthed in a deck-house amidships, and the crew in topgallant forecastle. There is also a large promenade deck amidships, at the fore end of which a house is erected in which is placed the captain's berth and the steam steering gear, which is by Messrs. Donkin & Nichol, of Newcastle. Tri-compound engines are fitted by the North-Eastern Marine Engineering Company, Limited, having cylinders 18 in., 29 in., and 48 in. diameter by 33 in. stroke, 160 lbs. working pressure. The vessel is built upon exceedingly fine lines, and a high rate of speed is expected to be obtained. During construction the hull and machinery have been inspected by Mr. James Rode, of Liverpool, as well as by Mr. Suarez and Captain J. De Bilbao. On leaving the ways she was named *Elena Oms* by Miss Hands, of Sunderland.

Iser.—On September 26th there was launched from the shipbuilding yard of Messrs. C. S. Swan and Hunter, Wallsend, a steel screw steamer of the following dimensions:—Length, 284 ft.; breadth, 38 ft.; depth moulded, 22 ft. 1 in. The vessel, which is classed 100 A1 at Lloyd's, and built under special survey, is of the improved well-deck type, with full poop, long-raised quarterdeck, long bridgehouse, extending well forward, topgallant-forecastle, water ballast in a double bottom. The engines, which are of the triple-expansion type, have been built by Messrs. Blair and Co. (Limited), Stockton, and are capable of indicating about 1,150 H.P. On leaving the ways the vessel was named the *Iser* by Miss Ethel Brown, of Sunderland. The *Iser* has been built to the order of Messrs. Glover Bros., for the Mercantile Steamship Company (Limited), London.

Elbruz.—On September 27th there was launched from the Low Walker yard of Sir W. G. Armstrong, Mitchell & Co., a steel spar-deck tank steamer, specially constructed for the carriage of petroleum in bulk under the inspection of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool, who are also inspecting a second similar vessel both built to the order of Messrs. Lane & Macandrews, of London. The vessel is rigged as a three-masted schooner, and is 310 ft. long B.P., and extreme breadth 40 ft. 3 in., with a moulded depth of 29 ft. 6 in., and is constructed to carry 4,000 tons on a light draught of water. The oil is carried in seven tanks. The vessel will be fitted with triple-expansion engines, with cylinders 23 in., 37 in., and 60 in., by 39 in. stroke, also by Sir W. G. Armstrong, Mitchell & Co., and calculated to drive the ship over nine and a-half knots when loaded.

Ville de Dieppe.—On September 29th there was launched from the yard of Messrs. Oswald, Mordaunt & Co., of Southampton, a steel sailing barque specially built for the carriage of petroleum in bulk. The vessel is to the specification and under the inspection of Messrs. Flannery, Baggallay & Johnson, who have from the commencement of this trade been engaged in designing vessels specially suited to it. The *Ville de Dieppe* is 260 ft. long, 36 ft. beam, 20 ft. 9 in. depth of hold, and is capable of carrying 1,700 tons of petroleum upon a draught of 19 ft. The bulkheads are specially strengthened so as to allow the whole of the tanks, which are six in number, being filled with petroleum or a portion of them only filled with water ballast. The pumping arrangements, although only adapted for hand service, are very complete and include separate piping for the water ballast as distinct from the oil. The vessel will have steel masts stepped on to the tank top and with special strengthening where connected to the tank top, this being necessary because the mast cannot be carried down to the keel as is usual in sailing ships of ordinary construction. There is an ample 'tween decks for purpose of safety and expansion chambers to each cargo tank extending up through the 'tween decks and above the upper deck, which are closed with portable plate covers capable of easy removal for the purpose of ventilation. The vessel is built to the order of MM. Robbe Fils, of Dieppe, and was gracefully christened by Madame J. Robbe.

Russian Prince.—On October 1st, at Armstrong, Mitchell and Co.'s Elswick shipyard, an oil-carrying steamer was launched, 310 ft. long by 40 ft. beam by 28 ft. 3 in. depth of hold. Her gross register tonnage is about 2,740 tons, and her carrying capacity 4,000 tons. She has been built for Mr. James Knott, of Newcastle-on-Tyne. Miss Hurst named the vessel the *Russian Prince*. She will be fitted with the most improved type of triple-expansion engines of 23 in., 37 in. by 60 in. diameter of cylinders, by 39 in. stroke, by the Wallsend Slipway and Engineering Company. This vessel is a sister-ship to the *Gut Keil* (s.) built by the same firm at their shipyard, Low Walker. Both these vessels have been built under the inspection of Mr. John Gravel, surveyor to the Bureau Veritas, and have taken the highest class in the Registry of Shipping. The engines have been built under the survey of Mr. A. G. Schaeffer, of Newcastle.

A New Lightship.—On October 3rd Messrs. Robert Stephenson and Co. (Limited) launched from their shipyard at Hebburn, the second of the two composite lightships which they have built for the Corporation of the Trinity House, London. The first lightship was delivered at Trinity wharf, London, during last month, and was inspected by the Committee of the Elder Brethren, who have expressed great satisfaction with the excellence of the workmanship and general finish of the vessel. After fitting out she will be placed on station at the Outer Gabbard, a dangerous locality on the Deeps, where hitherto no lightship has been moored.

Alberta.—On October 4th there was launched from the shipbuilding yard of Messrs. Schlesinger, Davis & Co., at Wallsend, a handsomely-modelled steel screw steamer built to the order of Messrs. Leech, Harrison & Horwood, of Liverpool; the principal dimensions are as follows:—Length between perpendiculars, 170 ft.; breadth, moulded, 26 ft.; depth, moulded, 13 ft. 4 in. The vessel has been built to the highest class at Lloyd's; she has a long full poop, topgallant forecastle, and is fitted for water ballast in the fore and after peaks, also under the engines and boilers. All the latest improvements have been introduced for the rapid loading and discharging of cargo. Accommodation for the captain and officers is provided under the poop at the fore end, the engineers being berthed at the after end of the engine-room, the forecastle being fitted up in a neat and substantial manner for the crew. The vessel will be rigged as a two-masted fore and aft schooner, and will be fitted with triple-expansion engine and steel boiler by the North-Eastern Marine Engineering Company, Limited, Wallsend, the sizes of the cylinders being as follow: 14 in., 23 in., and 39 in. by 27 in. stroke. The vessel was named the *Alberta*.

Marie.—On October 4th Messrs. W. Gray & Co. launched a fine steel screw steamer of the following dimensions:—Length, overall, 281 ft.; beam 36 ft. 6 in.; depth, moulded, 21 ft. 6 in.; built to the order of Messrs. J. Christensen & Co., Bergen, Norway; to class 100 A1 at Lloyd's and A1 at "Det Norske Veritas" Registry. The vessel will have large internal and deadweight capacity. She is of the improved well decked type, with poop aft containing saloon and cabins for officers and a few passengers, long raised quarterdeck, long bridge of extra strength right up to fore hatch and containing comfortable quarters for the crew; the usual topgallant forecastle is fitted forward with Emerson, Walker, & Co.'s windlass working patent stockless anchors right into the hawse pipes, without the aid of cat and fish tackling. The hull is built on the web-frame principle, dispensing with hold beams and giving a clear hold for stowing cargo of the bulkiest description; five hatchways are fitted, four steam winches, steam steering gear, and two donkey boilers, double bottom under each hold for water ballast. The boats are carried on beams overhead and the vessel will in every respect be well equipped for general trading. First-class engines on the three-cylinder triple-expansion principle working on three cranks, are being supplied by the Central Marine Engineering Company, West Hartlepool. They will develop over 750 H.P., the cylinders are 20 in., 31½ in. and 53 in. diameter, and the piston stroke 36 in., and a constant supply of steam at a working pressure of 150 lbs. per square inch. will be maintained by five large steel boilers. The vessel has been superintended during construction by Captain Schjott on behalf of the owners. She was gracefully christened *Marie* by Mrs. Hans B. Olsen, West Hartlepool.

Euxine.—On October 4th the steamer *Euxine* was successfully launched from Messrs. J. F. Waddington & Co.'s shipbuilding and Engineering Works at Seacombe, having all the machinery on board, steam up and complete with all fittings and outfit ready for sea. She is built of steel to class 100 A1 at Lloyd's to the order of P. G. Lambros, Esq., of Liverpool, for the Mediterranean trade. Her principal dimensions are 125 ft. long, by 20 ft. beam, and 9 ft. deep, having compound steam-condensing engines by the same builders, to indicate about 170 H.P. The vessel is fitted with topgallant forecastle and full poop, containing saloon and four state rooms for the accommodation of ten first class passengers, and has also a 14-ft. radius steam deck crane to work the two hatches.

Newton.—On October 6th, at the shipbuilding yard of Messrs. R. and W. Hawthorn, Leslie and Company (Limited), a steel screw steamer was launched of the following dimensions:—Length, 320 ft; breadth, 39 ft.; depth, 28 ft. The vessel was built of Siemens'-Martin steel on the cellular bottom principle, with water ballast all fore-and-aft. The vessel has a poop, long bridge and forecastle, the poop being fitted for the accommodation of first-class passengers. The vessel was named the *Newton* by Miss Alice Ridley, daughter of one of the directors. She has been built to the order of Messrs. Lamport and Holt, of Liverpool.

British Prince.—On October 6th, at Messrs. Short Bros.' yard, Pallion, Sunderland, there was launched a screw steamer, built to the order of the Prince Steam-shipping Company. The vessel is of the following dimensions:—Length, 290 ft.; width, 39 ft.; depth moulded, 21 ft. 2 in. She is constructed to the highest class for steam at Lloyd's Registry. There are four large hatchways, with a powerful steam winch at each, and she is

Emerson, Walker and Co.'s patent windlass. The ... are being constructed by Messrs. Clark of South... H.P., on the triple-expansion principle. On ... vessel was named *British Prince*, the ... med by Mr. M'Dermott.

... ber 6th, at the yard of the Tyne Ship... ..., Willington Quay, a steel screw steamer ... ft. long, 37 ft. broad, and 23 ft. 6 in. deep. ... of the vessel is 2,000 tons, and she will carry ... deadweight. The engines, which are large and ... been built by the North-Eastern Engineering ... and will work at 160 lbs. pressure. The vessel is ... with all the modern appliances and improvements. ...ded for Atlantic and general carrying trades, and ... built to the order of Mr. James Wait, of Newcastle. ... named the *Brunel*.

Ismailia.—On October 6th, a screw steamer, built to the ...der of Messrs. Nelson, Donkin and Co., Newcastle, was ...unched from the yard of the Palmer Shipbuilding and Iron ...ompany (Limited), at Jarrow. The vessel, which is con...structed of steel, is 347 ft. in length between perpendiculars, 41 ft. broad and 29 ft. (moulded). Her gross registered tonnage is 3,136; she has three decks, with extra strength, the main and upper ones being of steel, and her class is 100 A1 at Lloyd's. The steamer is fitted for carrying Government troops and emigrants, and she has also first-class passenger accommodation. There is a full poop, in which the captain and officers will be located, long bridge amidships, and topgallant forecastle, in which are the berths of the crew and firemen. Water ballast tanks are all fore-and-aft in cellular bottom, and the vessel has six watertight bulkheads. Five steam winches, with all cargo gear complete. Harfield and Co.'s direct steam capstan windlass, Muir and Caldwell's steam steering gear amidships, and Hastie's screw gear aft have been fitted on board; and the engines, which are also made by the Palmer Company, will be on the triple-expansion principle. The hull has been built under the superintendence of Mr. J. Rankine. The vessel as she left the ways was named the *Ismailia*, the ceremony being performed by Mrs. Phillips, wife of Mr. W. H. Phillips, head-master of the High School at South Shields.

Ivieciffe.—On October 6th was launched from the shipbuilding yard of Messrs. Craig, Taylor and Co., Stockton-on-Tees, an iron screw steamer of the following dimensions:—Length, 281 ft. 3 in.; breadth, 40 ft.; depth, 20 ft. 11 in. The vessel has been built with a long raised quarter-deck, bridge extending to and including foremast and forewinch, short well, and topgallant forecastle. She is fitted with web frames in the holds and in peak for about 500 tons. She will be fitted with four steam winches and steam steering gear by Messrs. Roger and Co., of Stockton, patent steam windlass by Messrs. Emerson, Walker and Thompson Bros., Messrs. Hastie's screw gear aft, and all modern improvements, so as to admit of rapid loading and discharging. The engines, on the triple-expansion three-crank system, are being constructed by Messrs. Westgarth, English and Co., Middlesbrough, and are of the following sizes:—Cylinders, 22 in. by 35 in., and 57 in. by 39 in. stroke; two large steel boilers, 150 lbs. pressure. The vessel has been built to the order of Messrs. Douglas H. Morgan and Co., of Newport, Monmouth, and was named the *Ivieciffe* by Mrs. Craig. The vessel and her machinery have been surveyed during construction by Captain Pawley, the owners' superintendant.

Antonio.—On October 6th Messrs. Finch and Co. launched from their yard at Chepstow a small steamer, named *Antonio*, built to the order of the Brazilian Coal Company, of Rio de Janeiro, to carry 30 passengers. This little steamer was launched with steam up, and at once proceeded on her trial trip, which was most satisfactory.

Lighters.—On October 6th Messrs. Edward Finch and Co. launched from their yard at Chepstow two 150-ton steel coaling lighters, Nos. 52 and 53, built to the order of the Lords Commissioners of the Admiralty; and on the 8th another 150-ton steel coaling lighter, being No. 54, was also launched to the same order.

Abydos.—On October 6th Messrs. Wigham Richardson and Co. launched at Newcastle the latest addition to the fleet of the Kosmos Steam Navigation Company, of Hamburg, in the shape of a mail and passenger steamer, 300 ft. long by 36 ft. beam and 26 ft. deep, with machinery of the builders' own make, to maintain a speed of 12 knots at sea. The christening ceremony was performed by Miss Richardson, the daughter of the head of the firm, and the ship was named *Abydos*. She has been built under the superintendence of Captain Siegmund and Inspector Jensen, and is the third steamer which the firm have built or engined for the Company. She is fitted with patent direct-acting windlass and steam winches, by Emerson, Walker & Co. (Limited).

Humber.—On October 9th Messrs. W. Gray & Co. launched a fine steel screw steamer of the following dimensions:—length overall, 280 ft.; breadth, 38 ft.; depth, 21 ft. 9½ in.; built to the order of the Mercantile Steamship Company, Limited, of London. The vessel takes Lloyd's highest class; she is of the well-decked type, with poop aft, containing handsome saloon and cabins for officers and a few passengers, long raised quarter-deck and a long bridge of extra strength carried right to the forehatch, and containing accommodation for the engineers, petty officers, &c. The topgallant forecastle has comfortable quarters for the crew. Napier Brothers' direct steam windlass is fitted, and Tyzack's patent stockless anchors stowing into the hawse pipes without the aid of the usual cat and fish tackling. The hull is built on the web-frame principle, dispensing with hold beams and giving a clear hold for working cargo; five hatchways are fitted, four steam winches, steam steering gear, a patent donkey boiler, and double bottom under each hold for water ballast. The boats are carried on beams overhead and a complete equipment is provided for general trading. Five triple-expansion engines, having cylinders 22 in., 35 in., and 59 in. diameter, with a 39 in. stroke of piston, giving 1000 H.P., and two steel boilers to work at 150 lbs. pressure per square inch, are being supplied by the Central Marine Engineering Company, West Hartlepool. The vessel was gracefully christened *Humber* by Miss Baines, of West Hartlepool. This is the fourth steamer built by Messrs. W. Gray and Co. for the same firm. We may add that the hull and machinery of the *Humber* have been built under the superintendence of Mr. Terrot Glover, of Sunderland.

Gemini.—On October 11th there was launched from the shipbuilding yard of Messrs. J. Priestman & Co., Southwick, Sunderland, a screw steamer of the following dimensions:—Length between perpendiculars, 210 ft.; extreme breadth, 31 feet; depth of hold, 15 ft. 6 in.; gross tonnage, about 1,000. Class 100 A Lloyd's. She has been built to the order of Mr. J. G. Hill, of Sunderland, and is the first of two sister ships at present building by the firm for this gentleman. The vessel will carry about 1,350 tons deadweight, and is intended principally for the coal trade. Water ballast tanks are fitted in fore and after holds, capable of containing about 200 tons. The main and quarter decks are of iron. The cabin, with accommodation for officers, is arranged under a long bridge amidships, whilst the crew are berthed under the topgallant forecastle. This steamer is especially adapted for the rapid discharging of cargo, and is fitted with three steam winches by Messrs. Welford Bros., Davis's patent steering gear, Hastie's patent gear aft, and Emerson Walker's windlass. Her engines, which are to be supplied by the North-Eastern Marine Engineering Company, Limited, Sunderland, are on the tri-compound principle, and of 100 H.P. nominal and 550 effective. The size of the cylinders is 17 in., 28 in., and 46 in. with 30 in. stroke. The ship received the name of the *Gemini* from Miss Nellie Hawdon.

Colchester.—On October 16th Messrs. Earle's Shipbuilding and Engineering Company, Limited, launched from their yard at Hull a fine twin-screw steamship, built of steel to the same scantlings as if of iron, for the Great Eastern Railway Company's passenger service between Harwich and Antwerp. She is the fourth steamer built by Earle's Company for the same owners, and although generally similar in design to her predecessors, s.s. *Norwich* and s.s. *Ipswich*, she has, like her sister-ship the *Cambridge*, several improvements and additions as required by the exigencies of the service. The vessel has been named the *Colchester*, and her dimensions are 280 ft. by 31 ft. beam, by 15 ft. depth of hold, and she is designed with long bridge, poop, and topgallant forecastle, leaving open spaces between these for deck cargo. The whole of the first-class accommodation is arranged under the bridge and foreward of the machinery space; the second-class under the poop, and the seamen below the main deck forward, the space under the forecastle being available for horses and cattle. The officers are berthed under the bridge abaft the first-class cabins. There are permanent berths, dining saloon, ladies' cabin, smoke-room, lavatories, &c., in the most efficient style, for 160 first-class passengers, 56 second-class, and about 100 steerage in the 'tween decks aft. The whole of the passenger space, crew's quarters, and engine-room is fitted with the electric light, and steam heating is provided throughout the ship. Trimming and assisting in keeping a suitable

draft of water for speed will be effected by means of water ballast. Special attention has been given to the stiffening of the hull, to reduce vibration as much as possible. The stern frame and propeller brackets are of cast steel by Messrs. W. Jessop & Sons, Sheffield. The ship will be schooner rigged, and four powerful steam winches are supplied for the rapid discharge of cargo. She will be fitted by the builders with two sets of engines, which will develop 2,200 I.H.P., steam for which will be supplied from two double-ended boilers of large size.

Eugenie.—On October 18th there was launched from the yard of Messrs. Raylton Dixon & Co. a steel screw steamer named the *Eugénie*, which has been built to the order of Mr. Christopher Furness, West Hartlepool, for Messrs. Mohr & Son, of Bergen. Her leading dimensions are as follows:—Length, 304 ft. 3 in.; breadth, 38 ft.; depth moulded, 22 ft. 10 in.; with a carrying capacity of 3,600 tons. She is built with long bridge, extending to beyond foremast, water ballast on cellular bottom, and in every way up to the latest type of well-decked steamers. Her engines by Messrs. T. Richardson & Sons, of Hartlepool, will have cylinders 22 in., 35 in., and 59 in. by 39 in. stroke. On leaving the ways she was christened the *Eugénie* by Mrs. Arthur Lennard, of Richmond, Surrey.

Ursa.—On October 19th Messrs. Edward Withy and Co. launched from their shipbuilding works at Hartlepool a large steel screw steamer, built to the order of Messrs. Herskind & Woods, of West Hartlepool. This vessel is a fine type of a modern cargo boat, measuring over 330 ft. in length, and built throughout of Siemens-Martin steel, with a large measurement and deadweight capacity, and built to the highest class at Lloyd's. She has a long raised quarter-deck, short poop, long bridge-house and topgallant forecastle. The holds are fitted with iron grain divisions and iron cargo battens; all decks, deck erections, skylights, bulwarks, bulkheads, etc., are constructed of steel and iron. In the main and after holds the vessel is built on the web frame system, which gives a very strong type of ship, and dispenses with all hold beams, thereby enabling the ship to carry cargoes of the bulkiest description. This type of construction has met with much favour among shipowners, and since it was introduced into this district by Messrs. Edward Withy and Co. nearly 100 vessels have been built by them of this design. Her cellular bottom is fitted all fore and aft for water ballast (Withy and Sivewright's patent). The greater portion of the plates are in 24-ft. lengths, making the structure of the ship very strong. Four steam winches, donkey boiler, Pepper's steam steering gear amidships, screw gear aft, direct steam windlass on forecastle, patent stockless anchors hauling up into hawse-pipes, and all other modern appliances are fitted for the handy working of the vessel. The saloon and cabin, providing accommodation for passengers, captain, and officers, is handsomely finished in polished hardwood, with neatly painted panels executed in a very effective style by the decorative staff of ladies employed by the firm. The vessel will be rigged as a two-masted fore-and-aft schooner, with steel pole masts, derricks, and all other cargo appliances for expeditious handling of cargo. The machinery has been constructed by Messrs. T. Richardson and Sons, Hartlepool, and is of the most modern type, having three cylinders and two large single-ended boilers. The furnaces of the two large single-ended boilers are fitted with Fothergill's system of artificial draught; this arrangement has proved so successful that the owners are fitting it into all the steamers of their fleet. The hull has been constructed under the personal supervision of Captain Petersen, and the machinery by Mr. Fothergill. On leaving the ways the vessel was gracefully christened *Ursa* by Miss Hilda Mary Woods, daughter of one of the managing partners.

Steel Coaling Lighter.—On October 20th there was launched from the shipbuilding yard of Messrs. Edward Finch and Co., Chepstow, two 150-ton steel coaling lighters, being Nos. 55 and 56, built to the order of the Lords Commissioner of the Admiralty.

Premier.—On October 22nd there was launched from the shipbuilding yard of Mr. Jos. T. Eltringham, South Shields, an iron steam trawler, named the *Premier*. The vessel has been built to the order of Mr. Geo. Scott, jun., of North Shields. She is 86 ft. long, 17 ft. 6 in. broad, and 9 ft. 9 in. deep. The engines, compound surface condensing, of 40 N.H.P., with cylinders 16 in. and 30 in. diameter by 22 in. stroke, will be fitted by Messrs. Baird and Barnsley, North Shields, and include all the latest improvements.

Nile.—On October 22nd Messrs. Cochrane, Cooper, and Schofield launched from their shipbuilding yard at Grove Hill, Beverley, an iron steam trawler, built to the order of Messrs. Charles D. Holmes and Co., for Mr. T. Hamling, of Hull. The vessel has been built under special survey to class 100 A1 at Lloyd's, and is of the following dimensions:—Length between perpendiculars, 100 ft.; extreme breadth, 20 ft. 3 in.; depth to top of floors, 10 ft. 6 in. She will be fitted with Messrs. Charles D. Holmes and Co.'s improved type of triple-expansion engines, together with a large steel boiler, constructed for a working pressure of 150 lbs. per square inch. This vessel, when complete, will have powerful engines. On leaving the ways the vessel was christened the *Nile* by Mrs. Robinson, of Hull.

North Flint.—On October 22nd, at the shipbuilding yard of Messrs. John Readhead and Co., West Docks, South Shields, a steel screw steamer of the following dimensions was launched, viz.:—Length, 290 ft.; breadth, 39 ft.; depth of hold, 20 ft. The vessel has been built to the order of Messrs. Hugh Roberts and Son, of Newcastle, under the supervision of Messrs. Ferrina and Bushell and Captain John Owen, and will be classed 100 A1 at Lloyd's. She is of the improved well-decked type, and constructed to comply with the Grain Cargoes Act. The engines are on the triple-expansion principle, having cylinders of 22 in., 36 in., and 60 in., and a stroke of 39 in. The steam will be supplied from two large steel boilers, working at a pressure of 160 lbs. to the square inch. The steamer will carry about 3,400 tons deadweight. She was named the *North Flint* by Mrs. E. Owen, of Cardiff.

Lyndhurst.—On October 22nd there was launched from the shipbuilding works of Messrs. Wm. Pickersgill and Sons, Southwick, Sunderland, a steel screw steamer of the following dimensions:—Length, 270 ft.; breadth, 40 ft.; depth, 21 ft. 6 in.; built to the order of Messrs. Morel Brothers and Co., of Cardiff. This is the fifth vessel constructed by the builders for the same owners, and she has a long raised quarterdeck, long bridge to foremast, and topgallant forecastle. She is built to the highest class at Lloyd's, and all decks and deck erections are of steel and iron. The officers are berthed in cabins amidships and the crew in topgallant forecastle. The main and after holds are built on the web-frame and intercostal system, with cellular double bottom fore and aft. She has four large steam-winches by Messrs. Welford Brothers, Pallion, two donkey boilers, Davis's steam steering gear, Emerson and Walker's patent steam windlass, steel masts, and is fitted up with all the modern appliances for quick discharge of cargo. Her engines and boilers will be supplied and fitted by Mr. George Clark, of Southwick, on the triple-expansion principle. During her construction, the vessel has been superintended by Mr. Alexander Taylor, of Newcastle, and Captain Phalps. On leaving the ways she was named the *Lyndhurst* by Miss Pickersgill.

Hamburg.—On October 22nd there was launched this handsome little vessel, the latest addition to the Svenska Lloyd Line, from the yard of William Doxford & Sons, Sunderland. She is intended to run on the regular line between Gothenburg and Hamburg, and will be the swiftest vessel yet employed in the service. She is 200 ft. long by 27 ft. beam, and is registered to carry 875 tons deadweight, and steam eleven knots. Her engines are to be triple-expansion, having cylinders 18 in., 24 in., and 48 in. diameter, with 30 in. stroke, and will be backed by exceptionally large boilers to give an I.H.P. of a little short of 1,000 horses. She is built of steel to Lloyd's highest class, under special survey, and has also been surveyed throughout her construction by Captain Wetterstrom for the owners. She has cellular bottom for water ballast, and is divided by five water-tight bulkheads. Above the main deck is a long, full poop, fitted for twenty first-class and forty-eight second-class passengers; and forward she has a long, open forecastle for shelter, the crew being aft. The sides of the poop and forecastle are continued fore and aft, and are fitted with gangway doors to facilitate shipment of cargo. There are also six special ports for shipment of railway iron, which is extensively carried. The first-class cabin will be fitted in hardwood, and have electric bells throughout. Electric lighting will also be fitted throughout, special attention being devoted to the lighting of decks for discharging and shipping cargoes. The christening ceremony was performed by Miss Mary Doxford, and at four o'clock the vessel gracefully glided into her native element, and within the hour her pole masts were shipped into place, and she presented a most yacht-like appearance.

LAUNCHES.—Scotch.

Velez Sarsfield.—On September 24th Messrs. Fleming and Ferguson, shipbuilders and engineers, Paisley, launched from

their yard a 500-ton twin-screw dredger. She is fitted with two sets of the builders' patent quadruple expansion engines to indicate 700 H.P., has steel gearing throughout, and is designed to cut in front making her own flotation, and is capable of dredging 600 tons per hour from a depth of 35 ft. She has been built to the order of Mr. T. A. Walker for the Buenos Ayres Harbour Works, and during construction has been under the supervision of Mr. J. H. Simpson, superintending engineer for Mr. Walker. She was launched with all machinery on board and steam up, and immediately proceeded down the river for trial of machinery preparatory to sailing for Buenos Ayres. As she left the ways she was named *Velez Sarsfield* by Mrs. Ferguson, Fergus Villa, Paisley, wife of one of the builders.

Alfonso XIII.—On September 24th Messrs. William Denny and Brothers launched from their Leven shipbuilding yard, Dumbarton, the screw steamer *Alfonso XIII.*, a vessel they have constructed for the celebrated Compania Transatlantica of Barcelona and Cadiz. All modern perfections in the way of hydraulic gear, electric light, refrigerating machinery, &c., have been brought into use, while her engines are of the latest and most efficient type. The dimensions of this steamer are 400 by 48 by 32, and she will have a gross tonnage of about 4,600 tons. For the working of cargo, this vessel is supplied with Messrs. Brown Brothers' hydraulic gear of the very latest type, all the derricks being slewed by the same power, while those on which it is found necessary are also topped by this means. She has, moreover, hydraulic appliances for lifting the anchors, steering the ship, lifting out and in the boats, and closing the water-tight doors. While one of the most perfect types of a passenger and cargo steamer, this vessel has also been fitted under the stringent rules of the Spanish Admiralty for the purposes of a cruiser, and will be supplied with the necessary guns on her arrival in Spain. Meantime, the builders are fitting all the strengthening and other arrangements necessary for the purpose. Her passenger accommodation will be of the most superb description, 245 first-class passengers and 56 second-class will be allowed for, while 30 men and 12 women will be accommodated in separate compartments in the third-class, and, over and above this, on the lower deck, will be fitted accommodation for upwards of 900 troops. The first-class state-rooms accommodate about 245 passengers. There are 28 state-rooms fitted up as special family rooms, and extra special rooms. Her machinery will be supplied by Messrs. Denny & Co., and will be of the triple-expansion type. Steam will be supplied to the engines by three double-ended boilers with 18 furnaces, at a working pressure of 170 lb. per square inch. Forced draught will be fitted, and she will develop a speed of 17 knots per hour, with a very moderate use of it. In the engine-room department the same completeness of outfit will be given. Weir's patent feedheater evaporator and independent feeding engines will be carried. The refrigerating engine is being made by the Haslam Company of Derby, and the electric light, which will be fitted by this special department of the builders' yard, will have the necessary power generated by two dynamos by Messrs. Paterson & Cooper, and driven by engines manufactured by Messrs. Paul & Co., of Dumbarton. A special feature of this vessel will be the artificial ventilation, which will be effected by means of fans driven by electric motors supplied by Messrs. King, Brown & Co., of the Rosebank Electrical Works, Edinburgh. The ceremony of naming the vessel the *Alfonso XIII.* was performed by Miss Denny, daughter of Peter Denny, Esq., of Helenslee, senior partner of the builders' firm.

Dunmore.—On September 26th there was launched from the shipbuilding yard of Messrs. S. M'Knight & Co., Ayr, a steel steamer built to the order of Messrs. Henderson & M'Intosh, Leith, and of 2,000 tons carrying capacity. Her dimensions are:—Length, 245 ft.; breadth, 34 ft.; and depth to floors, 17 ft. She is to be classed 100 A1 at Lloyd's. She has a long raised quarter-deck, bridge amidships, with cabin and officers' accommodation; topgallant forecastle for crew, water ballast in cellular double bottom, and is fitted with Napier's direct steam windlass, Hastie's steam steering gear, and with all the latest improvements for expeditiously loading and discharging cargo. The machinery, which will be supplied by Messrs. Hutson and Corbett, Glasgow, is triple-expansion—cylinders 18 in., 30 in. and 48 in. by 36 in. stroke, with large steel boiler of 160 lb. working pressure. The vessel, on leaving the ways, was named *Dunmore* by Miss C. M. Gibson, Edinburgh. The construction of the vessel has been carried on under the superintendence of Captain John Gibb, Glasgow, and the machinery has been superintended by Mr. D. A. Cormack, consulting engineer, Leith.

Haulbowline.—On September 27th Messrs. Wm. Simons and Co. launched complete, from their yard at Renfrew, one of their patent hopper dredgers, which has been specially constructed for dredging operations at H.M. Dockyard, Haulbowline. The hopper capacity is 360 tons, and the bucket ladder which works in a central well is adapted to dredge in advance of the vessel and close up to quay walls, and to a depth of 35 ft. under water level. Steel buckets are provided having capacity to raise 300 tons of free soil per hour. The vessel is fitted with a pair of compound surface-condensing engines, and mild steel boiler, also triple-barrelled steam mooring crabs at the bow and the stern for working the head and side chains. Comfortable cabins are fitted up for the officers and crew.

Winstanley.—On October 4th the Ailsa Shipbuilding Company launched from their yard at Troon a steel screw steamer for Captain Weatherill, of Messrs. M'Kenzie & Co., Dublin, for the general coasting trade. Her dimensions are 142 ft. by 25 ft. by 13 ft. moulded; has raised quarter-deck, bridge, and topgallant forecastle. She has been built under special survey, and classed 100 A1 at Lloyd's, and has all the latest appliances for rapid working of cargo. She is to be fitted by Mr. William Kemp, of Govan, with triple-expansion engines to indicate 500 H.P. As the vessel left the ways she was named *Winstanley* by Mrs. M'Kenzie, wife of the owner.

Strathblane.—On October 6th a steel screw-steamer, built to the order of Messrs. Birrell & Son, Glasgow, was launched from the yard of Messrs. Russell & Co., Port Glasgow. She is 294 ft. long, 40 ft. in breadth, and 19 ft. 6 in. in depth, and will carry about 3,600 tons deadweight. Her engines are being made by Messrs. James Howden & Co., Glasgow, and the diameter of the cylinders of the same will be 22½ in. by 35½ in. by 58½ in. by 39 in. stroke. The steamer is being fitted with all modern improvements, including Muir & Caldwell's steam steering gear, &c. She was named the *Strathblane* as she left the ways by Miss Isa M'Ewan, Kelvinside.

Restless.—On October 6th Messrs. Foster & Co., Dysart, launched their first vessel, a schooner, built on fine lines, and intended to class nine years at Lloyd's. Her dimensions are:—Length over all, 81 ft.; breadth, 19½ ft.; depth of hold, 9½ ft. She will carry about 135 tons. The owners of the new craft are Messrs. Hickmen & Cawthorn, of Goole. On leaving the ways the vessel was named the *Restless*, Mr. T. J. Cotton, of Crail, performing the ceremony.

Peninsula.—On October 6th Messrs. Caird & Co., shipbuilders, Greenock, launched a steel screw steamer for the service of the Peninsular and Oriental Steamship Company, of the following dimensions:—Length, 410 ft.; breadth, 48 ft.; and depth, 37 ft.; her burthen being 5,500 tons gross. On leaving the ways the new steamship was named *Peninsula* by Miss Taylor, daughter of Mr. H. J. Taylor, superintendent of the P. & O. Company at Greenock. The *Peninsula*, which is rigged as a three-masted schooner, is built of the best mild steel, and in accordance with Lloyd's rules for the 100 A 1 class. The steel used in her construction is that made by the Siemens' process. She has three complete steel decks, with hurricane deck. The houses on the spar deck comprise officers' cabins, music saloon, and smoking-room. Nothing has been omitted in her construction to ensure strength and safety, and with regard to the latter the water-tight bulkheads—eight in number—are carried up to the spar deck. The deck-houses, which are constructed of steel, have all double tops, and are lighted by scuttles. The vessel is fitted up with refrigerating engine and chambers, electric lighting machinery and plant, hydraulic cargo machinery, powerful direct-acting steam windlass and capstan by Emerson, Walker & Co., London, &c. The beams are all of the Butterly section, with wide top flanges. Space is given for 18,000 gallons of fresh water in the fore peak and mizen hold. She is furnished with 10 boats, all built of teak, and comprise six lifeboats, three cutters, one gig, and a steam launch, the latter being capable of steaming at the rate of 10 knots per hour. The officers' cabins, engineers' mess rooms, barber's shop, quartermasters' cabins, ship servants' cabins, &c., are complete in every detail. The *Peninsula*, which is expected to attain a speed of 15 knots, will be supplied by the builders with inverted direct-acting compound triple-expansion engines of the most improved type; also with three double-ended and two single-ended boilers. She has accommodation for 175 first-class and 35 second-class passengers. The *Peninsula*, which will fit out for sea at the Victoria Harbour, has been placed on the Admiralty list, her 'tween decks being fitted up for troops.

River Mersey.—On October 8th, Messrs. Robert W. Duncan and Co., Port Glasgow, launched a steel screw-steamer of 2,760 tons carrying capacity for Messrs. James Little and Co., Glasgow, named *River Mersey*. Length, 260 ft.; breadth, 37 ft.; depth, 24 ft. 9 in., moulded. She will be supplied by Messrs. Muir and Houston, Glasgow, with triple-expansion, direct-acting, surface-condensing, screw engines, with cylinders 18—29½ and 47 by 39 in. stroke. The ceremony of naming the vessel was performed by Mrs. W. J. Chrystal, 7, Park Circus, Glasgow.

Anglia.—On October 9th there was launched from the shipbuilding yard of Messrs. David and William Henderson & Co., Meadowside, Partick, a steel screw steamer, built to the order of Messrs. Henderson Brothers. The following are the dimensions:—Length, 340 ft.; breadth, 42 ft. 9 in.; depth, moulded, 31 ft.; gross tonnage, 3,250 tons. As she left the ways she was named the *Anglia* by Mrs. D. R. Dickson. The *Anglia* will be supplied by the builders with triple-expansion engines, the cylinders being 24 in., 40 in., and 66 in., with 48 in. stroke, and she will be fitted up with all the latest improvements for the rapid loading and discharge of cargo. Her cabin accommodation, which is limited, is on the upper deck amidships. When completed the *Anglia* will be employed in the Indian, Mediterranean, and Atlantic services of the Anchor Line.

Port Carlisle.—On October 9th there was launched from the shipbuilding yard of Messrs. Russell & Co., Greenock, an iron sailing barque of 1,300 tons register, to carry 2,050 tons dead-weight. The vessel, which has been constructed to the order of Messrs. Crawford & Rowatt, shipowners, Glasgow, is of the following dimensions:—Length, 232 ft.; breadth, 32 ft. 2 in.; and depth, 21 ft. 6 in. On leaving the ways the vessel was named *Port Carlisle*.

Stanley.—On October 16th there was launched from the Fairfield Shipbuilding and Engineering Company's yard at Govan a steel screw steamer of the following dimensions:—Length between perpendiculars, 200 ft.; breadth, extreme, 32 ft.; depth, moulded, 20 ft. 3 in.; gross tonnage, 1,000. This vessel has been built to the order of the Canadian Government for their united service between Prince Edward Island and the mainland, and has been specially designed by the builders under the supervision of Captain M. P. M'Elhinney, nautical adviser to the Canadian Government for that service. She has been built under special survey to class 100 A1 at Lloyd's, but the scantlings in every way are much in excess of Lloyd's requirements in order to resist the pressure of ice, which renders navigation a matter of extreme difficulty in the waters where she is intended to ply. She is to be fitted and equipped in accordance with the Board of Trade Regulations for passengers, and also to meet the requirements of the Canadian laws. First-class accommodation for about 30 persons is to be provided in a large deckhouse on the main deck forward of the boiler casing, while the space in 'tween decks aft is arranged for second-class passengers. The officers and engineers will be accommodated in the deckhouse on the main deck, the crew being berthed in the 'tween decks forward. The vessel is to be schooner-rigged, and will have a steam windlass, steam steering gear, and a full complement of boats. The passenger accommodation will be heated by steam throughout. This vessel is expected to obtain a speed of 15 knots per hour at load draught. The engines are of the triple-expansion type, with three inverted cylinders. The diameter of the high-pressure cylinder is 24 in., and that of the medium pressure and low pressure 40 in. and 60 in. respectively, and the stroke of each 3 ft. 6in. These engines have been designed and constructed for the special service for which the vessel has been built, every part being strong. The crank shafts are built and are made of mild steel. The propeller also has steel blades. Steam will be supplied to the engines by two double-ended tubular boilers. The boilers are constructed of steel throughout, and are adapted to work at 160 lb. pressure. The vessel on leaving the ways was named the *Stanley* by Miss Thompson, Cliffside, Craigmore.

Ardle.—On October 17th, a steamer named the *Ardle*, built by Messrs. Gourlay Brothers and Co., Dundee, for the North Sea Steam Shipping Company, was launched from Camperdown Shipyard. The vessel is of the well-deck type, built of steel; she is 245½ ft. long, 34 ft. in breadth, and her depth, moulded, is 18 ft. 1½ in.; her gross tonnage is about 1,390, and her net about 809. She will be fitted with triple-expansion engines of 160 N.H.P. The vessel is built on the cellular principle for carrying water ballast, and is fitted up with every requirement for the Baltic and Mediterranean trades. The electric light will be supplied throughout the whole ship. When the steamer left the ways she was named by Mrs. J. C. Buist. Captain Leighton, formerly of the *Garry*, has been appointed to the command of the *Ardle*.

Meyun.—On October 17th, Messrs. Scott and Co., shipbuilders, Greenock, launched a steel screw steamer of 175 tons register, named the *Meyun*, for the Perim Coal Company. The vessel is intended to be employed in connection with the steamship traffic of the Red Sea. She is to be supplied by her builders with compound surface-condensing engines of 250 I.H.P.

Oanfa.—On October 18th Messrs. Aitken & Mansel launched from their yard at Whiteinch the steel screw vessel *Oanfa*, for the China Shippers' Mutual Steam Navigation Company, Limited, of London. The dimensions of the hull are 355 ft. by 41 ft. 3 in. by 28 ft. 3 in., moulded, and the machinery, which will be fitted by Messrs. John and James Thomson, has an I.P. of 2,800 horse, the cylinders being 32 in., 49 in., and 77 in. by 48 in. stroke. This vessel is finished in the most substantial and complete manner for the requirements of the London and China tea trade, in which, along with the present fleet of the company, she will be exclusively engaged. In addition to having the highest class at Lloyd's and a Board of Trade passenger certificate, she has also been placed on the Admiralty Transport List. On leaving the ways Mrs. Hinton Stewart, of Strathgarry, performed the ceremony of naming the vessel.

Purnea.—On October 20th Messrs. A. & J. Inglis launched from their shipbuilding yard at Pointhouse, the *Purnea*, a steel screw-steamer of 3,350 tons gross, for the British India Steam Navigation Company (Limited), London, for their extensive Eastern trade. Her dimensions are:—Length, 350 ft.; breadth, 42 ft.; and depth, 29 ft. 3 in. She will be fitted with triple-expansion engines indicating 2,600 H.P. Accommodation has been provided for 35 first-class and 30 second-class passengers. The *Purnea*, which will be lighted throughout by electricity, will be furnished with all requisite appliances of improved description.

Adolf Deppe.—On October 20th there was launched from the shipbuilding yard of Messrs. John Duthie & Sons, shipbuilders, Footdee, Aberdeen, an iron screw steamer, called after the owner, Adolf Deppe, of Antwerp. The dimensions of the vessel are:—Length over all, 216 ft. 6 in.; breadth, 28 ft. 9 in.; depth of hold, 14 ft. 3 in.; with a gross tonnage of 882 tons, and a dead-weight carrying power of 1,050 tons. The *Adolf Deppe* has been built under special survey to class 100 A at Lloyd's, and will be schooner-rigged. She is built with four water-tight compartments, water ballast tanks, and is to be furnished with all the latest improvements to expedite the loading and discharging of her cargoes. Her engines are compound surface condensers of 98 N.H.P.

Una.—On October 20th there was launched from the shipbuilding yard of Messrs. A. Hall & Co., Footdee, Aberdeen, a steel screw steamer, named the *Una*, built to the order of the "Compania Pernambucana," of Pernambuco. Her dimensions are:—Length, 160 ft.; breadth, 26 ft.; depth, to top of floors, 10 ft. 6in.; to top of awning, 17 ft.; with a register tonnage of about 400 tons. The vessel is spar decked, and has been built under special survey, to class 100 A1 at Lloyd's. The *Una* has been built entirely of steel, and is to be rigged as a schooner. She will have triple-expansion engines of 70 N.H.P., with cylinders of 12 in., 19 in., and 32 in., with a stroke of 24 in., and is expected to reach a speed of from ten to eleven knots per hour. The new steamer will be supplied with the most modern improvements and appliances, and is to be engaged by her owners in their passenger and cargo traffic on the Brazilian coast. The ceremony of naming the vessel was performed by Mrs. Robilliard, of Liverpool.

Curfew.—On October 22nd a steamer named the *Curfew*, built to the order of Messrs. R. A. Mudie & Sons, Dundee, was launched from Caledon Shipyard, Dundee. Built of steel, the vessel is of the following dimensions:—Length over all, 284 ft.; beam, 37 ft.; depth of hold, 22 ft. 11 in.; gross tonnage about 1,900. The *Curfew* has been built to the highest class at Lloyd's, and is fitted with triple-expansion engines, also constructed by the builders. The bottom of the vessel is constructed upon the cellular system, which ensures a second skin available in case of the outer one being injured, this second bottom also serving the purpose of water ballast chambers. Five bulkheads sub-divide the vessel into watertight compartments. On the upper deck four steam winches are conveniently placed for the rapid handling of cargo. Steam for these and other auxiliary engines are supplied from a special boiler fired from the upper deck. Steam steering

gear, by Messrs. Alley & M'Lellan, is fitted in the wheelhouse, with controlling standard on the bridge above. Under the upper deck aft is the main cabin, with four state-rooms and the captain's apartments. Under the bridge deck amidships is the officers' mess-room, with the rooms for their accommodation on either side arranged to ensure thorough ventilation. On the fore part of the bridge deck is the chartroom and wheelhouse, surmounted by the look-out bridge. Under the forecastle deck rooms are provided for seamen and firemen, and on the deck above is placed the steam windlass (Emerson & Walker's) which works the anchors in conjunction with a heavy anchor crane. Two iron light-towers find a place on this deck, and carry the ship's side lights secure from extinction in the worst weather. The engines are of the triple-expansion type, having cylinders 21 in., 33 in., and 54 in., with a piston stroke of 42 in., each engine working on a separate crank. Steam is supplied from two single-ended steel boilers, at a pressure of 160 lbs. per square inch. The vessel is lighted throughout by electricity, this department having been entrusted to Messrs. Paterson & Cooper's local representative, Mr. Martin, of Glasgow. All the hold and deck lights are portable, those for the deck consisting of three-light clusters. Suitable connections are provided at frequent intervals throughout the vessel, so that these portable lights may be used in any part of the vessel. In addition to the usual electric lighting of a steamer, the *Curfew's* mast-head, side, and binnacle lights are lighted by electricity, the vessel having in all about ninety lamps. The vessel possesses the Board of Trade passenger certificate, and has a complete equipment of boats, &c. As the vessel left the ways she was christened by Miss Meta Mudie. Captain Sangster, formerly of the *Gloamin*, has been appointed to the command of the *Curfew*.

Semantha.—On October 23rd there was launched from the shipbuilding yard of Messrs. Wm. Hamilton & Co., at Port Glasgow, a four-masted sailing ship named the *Semantha*, net register tonnage 2,300 tons, and to carry 3,700 tons. This vessel has been built to the highest class at Lloyd's, and of steel throughout, with steel decks sheathed with wood, steam windlass, steam winches, Mill's patent pumps, and all the latest modern improvements for the speedy loading and discharging of cargo. She has been built to the order of Messrs. J. R. Haws & Co., of Liverpool, and will be commanded by Captain Dart. The vessel, after being fitted out, will load a general cargo at Port Glasgow for San Francisco. During her construction she has been superintended on the owners' behalf by Mr. John Steuart Jones, of Liverpool. The ceremony of naming was performed by Miss E. B. Hamilton, of Port Glasgow.

Queen Elizabeth.—On October 23rd there was launched at Linthouse by Messrs Alexander Steven & Sons, for Messrs. Thomas Dunlop & Sons, Glasgow, a fine steel screw steamer of about 4,000 tons deadweight carrying capacity, and which was named *Queen Elizabeth* by the wife of Mr. Thomas Dunlop, junr., Langbank. The *Queen Elizabeth* is built to the 100 A 1 class in Lloyd's, under special survey, and is in every respect a splendidly constructed and equipped cargo steamer. Having more than the requisite strength provided in the framework without the use of hold beams, the holds have the great advantage of being unhampered for the reception of cargo of the bulkiest kind. The structures above deck embrace a poop for carrying cargo; iron houses amidships, with accommodation for captain and officers; wheel house, &c., on bridge, with flying bridge on top. The crew are located in a topgallant forecastle. The engines are of the most improved triple-expansion type. The cylinders are 21 in., 33 in. and 54 in. diameter, by 42 in. stroke. Steam at 160 lbs. pressure is supplied from two steel boilers. The vessel, which is the third built at Linthouse for Messrs. Dunlop, is fitted with all the most efficient appliances, including steam windlass, steam steering gear, steam winches, large donkey boiler, &c.

LAUNCHES.—Irish.

Lady Martin.—On October 8th there was launched by Messrs. Workman, Clark, & Co., Limited, a handsome screw-steamer, built for the British and Irish Steampacket Company, Limited, Dublin, which is intended for their passenger trade between London and Dublin. She has large carrying capacity for general cargo, and her dimensions are—Length between perpendiculars, 271 ft.; breadth, moulded, 34 ft.; depth of hold, 16 ft. 6 in.; gross tonnage, 1250 tons. The vessel, which is built of steel, is to class 100 A 1 at Lloyd's, has two laid decks, the main being steel covered with wood; also long poop, bridge, and forecastle decks. The bulwarks between are carried up, which gives her the appearance of having a full, flush spar deck, all fore and aft. The wells between bridge and forecastle decks are just sufficiently large for the cargo hatches and working of cargo. Communication between these decks is by gangway planks. The arrangements for working cargo are two 5-ton and two 3-ton steam cranes on main deck. Large gangway doors are fitted abreast of each hatch. There will be a steam engine for warping purposes, and one of Harfield's steam windlasses on the forecastle deck. The vessel is divided into six watertight compartments, and is fitted with water ballast tanks, in fore and after holds, on the cellular principle, also a trimming tank in the forepeak, under the main deck. Accommodation for the captain will be in a large teak deckhouse, and the steam steering engine, which is Harrison's patent, will be enclosed in this house, with steering wheel above, on the flying bridge. There is an iron casing on bridge deck, enclosing the entrance to stokehold, and the engine skylight embraces the companion entrance to engine-room at after end. On the poop deck there is a large teakwood house, giving accommodation for a smoking-room, stateroom, and saloon companion. The saloon skylight, which is aft of this house, is large and fitted with opening sashes. On the main deck under the poop there is accommodation fitted up for seventy-four first-class passengers in addition to those in deckhouse above. Under bridge there is an iron casing the whole length of machinery space, containing entrances to stokeholds and engines; at fore end of this, accommodation for 46 second-class passengers is provided. Accommodation for engineers and officers is under the bridge deck on the starboad side. Behind the officers' rooms a comfortable bathroom is placed for first-class passengers, of large size, with a shower and steam heating pipe. On port side under the bridge, horse stalls will be fitted. The crew and firemen are housed forward under the forecastle deck, and there are also rooms for petty officers and steerage passengers. The vessel is rigged as a fore-and-aft schooner, with two steel pole masts, pitch pine booms, and foresail yard on foremast. Saloon, state-rooms, and engine-room, and officers' rooms are to be fitted with the electric light on the most improved system. The machinery is of the most recent description, being triple expansion, with cylinders 24 in., 39 in., and 64 in. diameter, by 45-in. stroke, and two boilers of steel, 15 ft. 6 in. long by 12 ft. diameter, fired from each end, made by Messrs. Dunsmuir & Jackson, Govan. The christening ceremony was gracefully performed by Miss M'Causland, in presence of a distinguished party, including—Sir Richard Martin, chairman of the Company; Mr. Luke J. M'Leonard, one of the directors; the secretary of the Company, Dr. Martin, Mr. and Mrs. Dunsmuir, Mr. Beith, Belfast Steamship Company, Limited; Mr. Heyn, Ulster Steamship Company, Limited; and Mr. Otto Jaffé. After the launch, luncheon was served in the Royal Avenue Hotel. The *Lady Martin*, during her construction, has been under constant superintendence of Mr. A. F. White, consulting engineer for the Company.

Cufic.—On October 10th a new screw steel steamer was launched from the Queen's Island Shipbuilding Yard in the presence of a very large number of spectators, who had assembled on the quays to witness the event. The steamer, which has been built for Messrs. Ismay, Imrie & Co. (the White Star Line Company), is named the *Cufic*, and will be an addition to the cargo-carrying vessels of the famous steamship company. Though the *Cufic*, which is the seventeenth vessel built on the Queen's Island for the White Star Line, is intended principally as a cargo steamer, yet she will have accommodation for a certain number of passengers. She is of very large dimensions, and will be engaged in the Atlantic traffic. The steamer will be fitted up with triple-expansion engines by Messrs. Harland & Woolf, and she will be lighted throughout with electric light, and in her construction all the latest improvements in gear, &c., will be taken advantage of. The launch took place most successfully, the vessel gliding into the water amidst the cheers of the spectators.

Paul Isenberg.—On October 19th was launched from the building yard of J. C. Biggar, Esq., of Londonderry, the steel barque *Paul Isenberg*, of 1,300 net register. She has been sold to Messrs. J. C. Pfluger & Co., of Bremen, through Messrs. Cloid, Routledge & Co., London, and intended for the Honolulu and San Francisco trade.

LAUNCH.—Norway.

Nicolaus.—On September 8th Messrs. Laxevaag's Shipbuilding and Engineering Company, Bergen, Norway, launched an iron screw steamer, *Nicolaus*, of the following dimensions:—

Length, over all, 293 ft.; breadth, 36½ ft.; depth, 20½ ft. Will be fitted with triple-expansion engines of about 800 I.H.P., class 100 A1*, 1st division Norwegian Veritas. The vessel is on the improved raised quarter-deck type, the bridge being carried forward before the foremast. Short raised poop aft with accommodation for the captain and a few passengers; officers and engineers under forepart of extended bridge; crew, in topgallant forecastle. Four steam winches of the firm's own make; Hartfield's patent windlass; Davies's patent steam steering gear. The vessel is on the web system, which gives a very strong type of ship, and dispenses with hold beams; decks of iron; cellular bottom throughout, also afterpeak available for water ballast. The vessel will be rigged with two pole masts. This is the largest cargo boat built in Norway, and the keel for a similar boat is being laid by the same company.

LAUNCH.—SWEDISH.

Steel Steamer.—On September 15th a new steamer was launched from Lindholmens Mekaniska Verkstad, Sweden, built to the account of the Bohnslänska Kusten Steamer Company, Uddevalla, Sweden. The steamer is built of Motala anchor steel and is 106 ft. long, 22½ ft. beam, and will, fully loaded, have a draught of 9½ ft., so that she will be able to pass the Göta and the Trollhätta canal. The engines are of the triple-expansion type, the three cylinders being placed behind each other. The boiler is fitted with corrugated furnaces. It is intended to work with a steam pressure of 160 lbs. per square inch. The new steamer will enter into the company's regular traffic when ready.

TRIAL TRIPS.

Santa Rita.—On August 23rd the steel stern-wheel steamer *Santa Rita*, built by Messrs. Forrestt & Son, of Limehouse and Wyvenhoe, for the Brazilian river service, went on her official trial trip on the river Thames, which proved highly satisfactory, the mean speed being over 12¾ miles, and, when towing a barge carrying thirty tons of cargo, over 11½ miles per hour. The *Santa Rita* is 66 ft. long by 13 ft. 2 in. beam and 3 ft. 3 in. deep, and her draft, with full equipment on board, was only 16 in. Her engines are of the compound surface-condensing type, and indicated 172 H.P.

Steel Twin Screw Steam Launch.—On August 25th a steel twin-screw steam launch, built by Messrs. Forrestt & Son, of Limehouse and Wyvenhoe, went on her official trial trip on the river Colne, when most satisfactory results were obtained, a speed of ten miles per hour being developed. The launch is 38 ft. over all by 8 ft. beam and 3 ft. deep, with 15 in. draught of water, and is fitted with two pairs of compound high-pressure engines. This is the first steel boat that has been built on the Colne.

Kirklands.—On September 22nd, the steamer *Kirklands*, lately built for Messrs. James R. Cuthbertson & Co., Glasgow, by Messrs. Workman, Clark & Co. (Limited), Belfast, and engined by Messrs. William King & Co., Glasgow, went on her official trial on the Clyde, and attained a mean speed of 11½ knots. This steamer has all the latest improvements, is 271 ft. between perpendiculars by 27 ft. by 26 ft. 2 in. moulded, with a deadweight carrying capacity of 2,900 tons, and a net register of 1,168 tons, and has been fitted with triple-expansion engines, having 19 in., 32 in., and 52 in. cylinders, and 42 in. stroke. The hull is of steel, with steel main deck, teak spar deck, and cellular double bottom for water ballast right fore and aft, all to Lloyd's highest class, and superintended during construction by Messrs. M'Nicoll and Co., Glasgow.

Knutsford.—On September 25th, the steel screw steamer *Knutsford*, built by Messrs. C. S. Swan and Hunter, for Messrs. Carlisle and Co., of London, went out on her official trial trip, which proved highly satisfactory, the mean speed being over 11½ knots. The *Knutsford* is 290 ft. long by 37 ft. 6 in. broad by 21 ft. 8 in. moulded depth, classed 100 A 1 at Lloyd's, and built under special survey; is of the improved well-deck type, with full poop, long raised quarter-deck, long bridge-house, and topgallant forecastle, water ballast in a cellular double bottom all fore and aft. The engines are triple-expansion surface-condensing, indicating about 1,150 H.P., and built by the Wallsend Slipway and Engineering Company (Limited), Wallsend.

Argus.—On September 26th a trial was made of the Trinity House steamer *Argus*, which Messrs. Day, Summers, and Co. have just converted from a paddle steamer into a twin screw. As a paddle steamer her seagoing speed was 10¼ knots, and the consumption of coal 26 tons per day. As a twin screw her seagoing speed is over 11 knots, and the consumption of coal per day 6 tons. The vessel is now fitted with two sets of triple-expansion engines, the diameter of the cylinders being 11½ in., 17½ in., and 30½ in., the stroke being 27 in. She has two steel boilers, 10 ft. 6 in. diameter by 9 ft. 3 in. long, and the working pressure is 150 lbs. On the occasion of the trial in Stokes Bay the average speed obtained on six runs at the measured mile was 11¼ knots, and the engines indicated 580 H.P.

Arctic.—On September 27th this ship, an iron screw fishing-vessel of a new type, which Messrs. Earle's Shipbuilding and Engineering Company, Limited, Hull, have built for the Grimsby Steam Fishing Company, Limited, to the order of Messrs. Moodys & Kelly, of Grimsby, had her trial trip. She is the first of two boats designed for line as well as trawl fishing, and possesses arrangements by which the fish, when caught, are kept in sea-water until the vessel reaches port and is ready for landing the catch. She was taken on her trial trip, leaving Grimsby after some delay (in consequence of the breakdown of one of the dock gates), at a little before eleven o'clock, and a course was made for Withernsea, where the test of her speed was to be made on the measured mile. The result was a mean of about nine and a half knots per hour, and much satisfaction was expressed with regard to the general appearance of the ship, her sea-going qualities, and the working of the machinery, which latter was got up to 136 revolutions, and indicated 285 H.P., without the least sign of heating or giving any trouble whatever. The owners were represented by Mr. Marshall (the chairman of the Company), Mr. Moody (director), and several of the shareholders and friends who were interested in the performance of this ship; and the builders by Mr. W. B. Dixon, manager of the engineering department, and Mr. Lodge, assistant shipyard manager.

Orbo.—On September 28th, the steamer *Orbo*, built by Messrs. William Hamilton and Co., Port Glasgow, for Messrs. Strong, Reid and Page, Liverpool, went down the river on her trial trip, having on board a party comprising representatives from the firms of the owners, builders, and engineers. After a preliminary run her speed was tested at the measured mile at Skelmorlie, when a mean speed of 11·88 knots per hour was obtained, everything working in a most satisfactory manner and giving excellent results. The dimensions of the steamer are 265 ft. by 37 ft. by 19 ft. 11 in. moulded. She is built of steel to the highest class at Lloyd's, with long raised quarter-deck, long bridge to fore mast and topgallant forecastle, water ballast throughout in cellular double bottom, direct steam windlass; Alley and McLellan's patent combined steam and hand steering gear, and all the latest modern improvements for efficiency and economy in handling cargo, &c.; and has been specially designed to carry a large cargo on a light draught of water. She is fitted with triple-expansion engines, having cylinders 21 in., 33 in., and 54 in. by 39 in. stroke, steam being supplied to same by two boilers, each 13 ft. diameter and 9 ft. 8 in. long, working at a pressure of 160 lbs., the machinery having been made by Mr. Wm. Kemp, Govan. After the trial the steamer returned to Glasgow to load for Galveston, and be under the command of Captain Hughes.

Las Mercedes.—On September 29th, the new steamer *Las Mercedes*, built by the Canada Works Company, Birkenhead, for Messrs. O'Hampo, Arana and Co., Buenos Ayres, underwent in Liverpool Bay her official trial trip, which was in every way successful, the vessel attaining on an average of five runs a mean speed of 10 knots per hour. The *Las Mercedes* is 200 ft. long, 34 ft. beam, 10 ft. depth of hold, 357 tons register, and has been constructed to suit the requirements of trade on the river Plate. The engines, which have also been supplied by the Canada Works Company, are of the triple-expansion style, with cylinders of 15½ in., 25 in., and 41 in., with a 30 in. stroke. These are supplied from a large cylindrical multitubular boiler, fitted with corrugated steel furnaces. The boiler is constructed to work up to a pressure of 160 lbs. per square inch, and the engines are capable of 110 revolutions. The steamer is fitted up with Messrs. Clarke, Chapman and Parson's (Gateshead) patent windlass, and also with their steam winch. She has been built especially for cargo-carrying, but she can also be utilized for towing purposes. The vessel has been fitted entirely, crew space included, with Parson's patent electric light, which will also be the illuminant for the masthead and the port and starboard sides. Her steam steering

gear is the "Sentinel," which is supplied by Messrs. Alley and Maclellan, Polmadie, Glasgow.

Millfield.—On September 29th the *Millfield* (s), built and engined by Messrs. John Readhead and Co., West Docks, South Shields, to the order of Messrs. J. H. Harrowing and Partners, of Whitby, was taken to sea for her trial trip, off the Tyne. The vessel is built of steel, and is of the improved well-deck type. Her dimensions are as follows:—Length, 290 ft.; breadth, 39 ft.; depth of hold, 21½ ft.; deadweight carrying capacity, 3,450 tons. She is classed 100 A1 at Lloyd's, and is fitted with all modern improvements. The engines are on the triple-expansion principle, of 250 N.H.P., and the boilers are of steel, working at a pressure of 100 lbs. to the square inch. The engines worked to the satisfaction of all concerned, and the speed maintained during a series of runs over the measured mile was equal to 12 knots an hour, the vessel being in ballast trim. After the trial the vessel was taken into Tyne Dock to load a cargo of coals for Genoa.

Gulf of Guinea.—On September 30th the *Gulf of Guinea* (s.), a new vessel 410 ft. long, 40 ft. 3 in. broad, and 23 ft. deep, which has been built by Messrs. R. and W. Hawthorn, Leslie & Co., of Hebburn-on-Tyne, for the Greenock Steamship Company (Limited), left the Tyne and proceeded to London. Her engines have been built by Messrs. Blair & Co. (Limited), of Stockton, and are on the triple-expansion principle. The engines have cylinders of 26 in., 42 in., and 69 in. diameter, by 48 in. stroke, and are of 300 N.H.P., working at 170 lbs. pressure of steam. The *Gulf of Guinea* is the second of four steamers being built by Messrs. Hawthorn, Leslie & Co., for the Greenock Steamship Company, and the machinery for which will all be supplied by Messrs. Blair & Co., who have previously engined eleven vessels for the same owners. The vessel made a very successful run, and attained a speed of 11 knots an hour.

Apex.—On October 5th the screw steamer *Apex*, built by Palmer's Shipbuilding and Iron Company, for Messrs. Newman, Dale & Co., of Newcastle, was taken on her trial trip. Her dimensions are—length, 275 ft; breadth, 37 ft. 6 in.; moulded depth, 21 ft. 8 in. She is built of steel to Lloyd's highest class, and rigged as a two-masted schooner. Water ballast on the cellular system is fitted all fore and aft, and there are five watertight bulkheads, direct steam windlass, by Clarke, Chapman and Co.; Donkin and Nichols' steam steering gear amidships, four steam winches, all cargo gear complete, and triple-expansion engines. The vessel will load about 3,100 tons deadweight on a moderate draught of water. On her trial the speed attained was 10¼ knots per hour, and the stroke of the cylinders 22, 35, and 58 in.

Euxine.—On October 6th the s.s. *Euxine* ran the formal trial trip on the measured mile, with the owner and a large party of friends on board, and attained a mean speed of ten knots, being one knot in excess of the contract speed, the engines working without the slightest hitch. The owner and the inspecting engineer (E. C. Gill, Esq.) expressed their entire approval and satisfaction at the performance of the vessel, and she will leave for her destination abroad in a few days. Messrs. J. F. Waddington and Co. have three more steamers in course of construction, including a stern-wheel steamer, which is the largest ever built in this port.

Lord Chancellor.—On October 9th the steam trawler *Lord Chancellor* left Hull for a trip down the river Humber. The measured mile was run off Withernsea, to the satisfaction of every one. The average speed of the vessel was 10½ knots. The sea qualities were tested, and she then steamed for the Humber. The *Lord Chancellor* was built by Messrs. Cook, Welton and Gemmell, under Lloyd's survey, to class 100 A1, and will be a fine addition to the Hull fishing fleet, every improvement having had the special attention of the owner. She is sister-ship to the *Prime Minister*, which had her trial trip a few weeks ago. Her dimensions are:—Length, 95 ft.; breadth, 20 ft. 9 in.; depth, 11 ft. The engines have been built by Messrs. C. D. Holmes and Co., under the superintendence of Mr. L. Simpson, and are of first-class workmanship. The engines are of the compound-cylinder type, 17 in. and 33 in. diameter, with a stroke of 22 in., and working pressure of 90 lbs. per square inch.

William Morphy.—On October 10th a trial trip took place off Shields of the new screw steamer, *William Morphy*, with full cargo on board. She was constructed by the Blyth Shipbuilding Company for Messrs. Holzapfel & Co., of London and Newcastle, and is intended for the Mediterranean fruit trade. The dimensions of the boat are as follows:—Length, 174 ft.; breadth, 26 ft.; draught, 14 ft. 6 in., with a deadweight carrying capacity of 900 tons. The engines have been built by Messrs. Ernest Scott and Co., of Newcastle-on-Tyne, and throughout the entire run gave complete satisfaction, not the slightest hitch occurring to mar the success of the day's proceedings. The engines are of the three-cylinder continuous expansion type, working at a pressure of 160 lbs. of steam, the sizes of the cylinder being as follows:—high pressure, 13½ in.; intermediate, 21 in.; low pressure, 35 in.; stroke, 27 in. The principal moving parts are of steel; while the bearings, which are of ample size, are lined throughout with white metal. The boiler was constructed by the Tyne Boiler Works, and easily maintained sufficient steam. The horse power developed was 450, with 27 in. of vacuum. The speed of the boat was easily maintained at nine knots, being more than expected. The *William Morphy* immediately after the trial left for Gibraltar.

Ethel.—On October 15th the new steamer *Ethel*, recently launched by the Grangemouth Dockyard Company from their shipbuilding yard there, went down the Firth of Forth on her official trial trip. The vessel has been built to the order of Messrs. William Christie and Co., of London and Ardrossan, is constructed of Siemens' steel, and classed 100 A1. Dimensions are as follows:—250 ft. between perpendiculars by 35 ft. beam, by 19½ moulded depth, and will carry a deadweight all told of 2,200 tons. She has been fitted with all the latest improvements for working both ship and cargo. Triple-expansion engines, 18 in. by 30 in. and 48 in. by 36 in., by Messrs. Hotson and Corbett; steam winches by Clark, Chapman, and the sentinel steam steering gear by Messrs. Alley and M'Lellan, Glasgow. The day being fine, a splendid trip was had in the Firth. On the measured mile a speed of fully 10¾ knots was obtained. The machinery worked smoothly and to the entire satisfaction of all those concerned.

Dartmeet.—On October 15th the s.s. *Dartmeet*, built and engined by Messrs. Harvey and Co., Limited, of Hayle, Cornwall, to the order of Messrs. Whiteway and Ball, of Torquay, went on her official trial. The steamer has been built to Lloyd's highest class, and is entirely of steel. She is fitted with water-ballast tanks, constructed on the cellular principle, from stem to stern, and has a registered tonnage of 327·24 tons, and a carrying capacity, including bunkers, of about 700 tons. Her dimensions are: length between perpendiculars, 183 ft. 7 in.; breadth, moulded, 28 ft. 5 in.; depth, 11 ft. 9 in. The decks and bulwarks are of steel. The engines are of about 500 H.P., and on the tri-compound system; the cylinders being 18, 29, and 48 in. diameter by 30 in. stroke. They are steamed by two boilers working at a pressure of 150 lb. per square inch, 11 ft. 6 in. diameter by 9 ft. 6 in. long, having a combined grate surface of 70 and a heating surface of 2,100 square ft. The three winches, windlass, steam steering gear, donkey and ballast pumps are all steamed by the main and donkey boilers. The trial trip was eminently satisfactory, the engines working with great regularity and smoothness and an entire absence of heated bearings. After adjusting the compasses, the steamer proceeded to Sunderland to load with house coals for Torquay.

Longstone.—On October 16th the s.s. *Longstone* proceeded on her trial trip from the Tees. This vessel, which has been built by Messrs. Rayltcn, Dixon & Co. to the order of Messrs. Farrar, Groves and Co., London, is of the following dimensions: length over all 304 ft. 3 in.; breadth 38 ft.; depth, moulded, 22 ft. 10 in., with a deadweight carrying capacity of 3,600 tons. She is built on the latest type of "switch-back" deck steamer, having long bridge to foremast, topgallant forecastle, &c. Her engines, which are by Messrs. T. Richardson & Sons, Hartlepool, with cylinders 22 in., 35 in., and 59 in., by 39 in. stroke, worked most satisfactorily during the trial, on the termination of which she proceeded to Newcastle to load for Alexandria. The vessel has been built under the superintendence of Mr. A. Thomson, of Messrs. Thompson & Fort, London.

Doris.—On October 16th the steamship *Doris*, which has been built to the order of Messrs. Aitken and Walker, Glasgow, by Messrs. Robert Duncan and Co., Port Glasgow, went down the Clyde to run her trial trip. The steamer had 2,800 tons deadweight in her, and the owners were very pleased with the result of the steaming. Messrs. Muir and Houston engined the steamer, and she obtained a speed of fully 9½ knots running the lights, and 9¾ knots on the measured mile.

Cyrene.—On October 17th the trial trip of the steamer *Cyrene* took place off Sunderland, in beautiful weather and under most favourable circumstances. The *Cyrene* was built by Messrs. Short Brothers, of Pallion. She is built of steel to the order of

Messrs. Lumsdon, Byers and Co., and is intended for the River Plate trade. Her dimensions are:—Length, 302 ft.; breadth, 42 ft.; and depth of hold, 27 ft. 6 in. The gross tonnage is 2,800, and her net tonnage about 1,900. She has a steel spar-deck covered with pitch pine, a topgallant forecastle, bridge-house, and a large house aft with smoke-room and saloon entrance. She is 7 ft. 11 in. between decks, and has water ballast. Among her fittings are five steam winches by Clarke, Chapman, Parsons and Co., Gateshead, also steam windlasses and steering gear by the same firm. She has also a large steel derrick capable of lifting 15 tons. The engines, which are of the latest triple-expansion type have been furnished by Messrs. George Clark and Sons, Southwick. The cylinders are 23½ in., 38 in., and 62 in., by 42 in. stroke and 150 lb. pressure. The engines are of 240 N.H.P. The vessel steamed out to sea for a considerable distance, and, after the compasses had been adjusted, was tried over the measured mile of Ryhope, when a speed of 13·26 knots was attained.

Glanystwyth.—On October 19th the steam screw steamer *Glanystwyth*, built by Palmer's Iron and Shipbuilding Company for Messrs. John Matthias and Co., of Aberystwith, was taken on her trial trip, when the vessel, which will load about 2,800 tons dead-weight on a moderate draught, attained the speed of 11 knots per hour. The vessel has been built to the highest class at Lloyd's, and all the latest improvements have been introduced for the rapid loading and discharging of cargo. She is fitted with triple-expansion engines.

Antonio.—On October 21st the steam launch *Antonio*, built by Messrs. E. Finch and Co., of Chepstow, for the Brazilian Coal Company (Limited), of Rio de Janeiro, sailed in charge of their engineer for Swansea, where she arrived at 4 p.m., having run the distance from Chepstow (85 miles) in eight hours, or about 10½ miles per hour. The hull is to be shipped whole (the engine and boiler being taken out) on board a steamer for Rio de Janeiro.

Elbruz.—On October 23rd the ss. *Elbruz*, lately launched from the Walker yard of Messrs. Armstrong, Mitchell & Co., was taken on her trial trip. The vessel is 310 ft. long, 40 ft. 3 in. beam, and 29 ft. 6 in. moulded depth, and is specially constructed for the carriage of petroleum in bulk, and she is intended to trade between the South of Russia and the United Kingdom. She has been built from the designs of Mr. Henry Sivan, Director of Messrs. Armstrong, Mitchell and Co., and under the inspection of Messrs. Flannery, Baggallay and Johnson for Messrs. Lane and Macandrew of London, and is capable of carrying 3,600 tons of oil, in addition to bunker coal. The engines have cylinders 23 in., 27 in. and 60 in. by 39 in. stroke working at 160 lb. boiler pressure, and on trial, with the vessel loaded with water ballast in her cargo tanks, the I.H.P. was 1,588, and the mean speed on the measured mile 10½ knots. The machinery worked extremely well throughout, and the vessel proceeds to Batoum for her first cargo.

Gracia.—The screw steamer *Gracia*, of Bilbao, built and supplied with machinery by Messrs. Wigham Richardson & Co., Neptune Works, Newcastle, to the order of Messrs. J. T. Nickels and Co., of Liverpool, for the Linea de Vapores Serra, went to sea, and, after the adjustment of compasses, ran along the coast for several hours' trial trip, the mean of the speeds taken on the measured mile being over 12½ knots, the machinery working most admirably, and giving the utmost satisfaction to the officials on board.

Correspondence.

[It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—Ed. M. E.]

STEAM BOILER INSURANCE COMPANIES.

To the Editor of The Marine Engineer.

Sir,—Would you be good enough to inform me, through the columns of your valuable paper, The Marine Engineer, 1st, The number of steam-boiler insurance companies in Great Britain; 2nd, Where their reports can be obtained; 3rd, The qualifications of their inspectors: are they mechanical engineers or boiler-makers, or other professions; and their salary; 4th, Did the Bill introduced into the House of Commons, England, to compel registration and inspection become law? 5th, The qualification of Board of Trade and Lloyd's surveyors of boilers.

The reason I ask this information is to gain knowledge on a subject which is attracting public attention in South Australia. There have been several boiler explosions on land lately, and the Government have promised to bring in a Bill to make inspection and registration compulsory. Would you kindly supply answers to above through The Marine Engineer, which paper I have taken in for many years? Hoping for an answer in an early number,

I am, Sir,

Your obedient Servant,

A. A. FAIRWEATHER,

July 30th, 1888. Engineer, Port Adelaide, South Australia.

[There are eleven steam-boiler insurance companies in Great Britain. The oldest and largest of them is the Boiler Insurance and Steam Power Company (Limited), whose head offices are at 67, King Street, Manchester. The company have branch offices in London and Glasgow, and more than ten thousand firms insure their boilers with it. The reports of the companies, or particular parts of them, can be obtained from their chief offices.

As to the qualifications of their inspectors, these vary considerably. Some companies merely employ local engineers at very small salaries, who have undergone no special training for their duties; but the inspectors of the company referred to are all well-trained men in the work they have to perform, and who have either been foremen engineers or boiler-makers. They are stationed in all our leading centres of industry. The salaries of inspectors of steam boilers differ very much. Some engaged by the smaller companies are, we are informed, paid as low as £80 to £100 per annum, while the more important inspectors engaged by the Boiler Insurance and Steam Power Company are liberally remunerated, their salaries averaging about £300 a year.

The Bill introduced into the House of Commons for the compulsory registration and inspection of steam boilers has not passed, nor is it probable that it will become law in the near future.

The required qualifications of Board of Trade and Lloyd's surveyors of boilers are, that the former must be extra first-class marine engineers, and must pass a further special examination as to their special fitness to inspect and determine the quality of boilers. To become a Lloyd's surveyor of boilers a person must satisfy the engineer surveyors of that establishment that he is thoroughly capable of discharging the duties of the office to which he wishes to be appointed, and he will be subjected to a severe examination by them, substantially similar to that which he would be required to undergo if he sought an appointment as surveyor of boilers to the Board of Trade.—Ed. M. E.]

THE FRENCH NAVY ESTIMATES.

THE estimates for 1889 of the Ministry of Marine give the following particulars as to the ships in course of construction in the State arsenals. Five ironclads are upon the stocks or are nearly completed—viz., the *Neptune*, the *Brennus*, the *Formidable*, the *Hoche*, and the *Magenta*. The *Formidable* will be furnished quite at the beginning of the year, and the *Hoche* soon after. A new ironclad is to be laid down at Lorient, but only £1,400 is to be spent on it next year. In the way of ironclad gunboats the *Cocyte*, a vessel similar to the *Achéron*, which is now on its trial trips, will be launched at Cherbourg, while the ironclad cruiser *Dupuy de Lôme* will be pushed on at Brest, and a second one laid down at Rochefort. In the way of first-class cruisers the *Isly* will be completed at Brest, the *Jean-Bart* at Rochefort, and the *Alger* at Cherbourg in 1890, all three of them being about two-thirds done by the end of next year. A second-class cruiser, the *Davoust*, will be finished at Toulon, and a third-class one, the *Surcouf*, at Cherbourg. One torpedo cruiser, the *Vautour*,

will be finished at Toulon, and a second, the *Wattignies*, to be completed in two years, will be begun at Rochefort. Two torpedo despatch-boats are to be laid down at Lorient, and two sailing frigates, the *Melpomène* and the *Andromède*, are being built as training ships outside the State arsenals. The ironclad *Marceau*, the cruiser *Cecille*, and four third-class cruisers, all of which are to be ready by next year, are in course of construction at La Seyne, and about twelve torpedo boats are to be pushed on. The cost of first-class ironclads ranges from £720,000 to £840,000, the cost of the *Formidable* being £824,172. The ironclad gunboats of the type of the *Cocyte* will cost £138,000; the ironclad cruiser *Dupuy de Lôme*, £416,290; the first-class cruiser *Alger*, £272,000; the second-class cruiser *Davoust*, £200,000; the third-class cruiser *Surcouf*, £130,800. The cost of labour is estimated at 3f. 30c. (about 2s. 8d.) per day for each man employed, and as there will be 2,700,000 days' work done in the five State arsenals, the credit asked under this head is £1,180,832.

Reviews.

Bell's Asbestos Company's New Catalogue.

In issuing their new catalogue of Bell's Asbestos Specialities, the Company call attention to the fact of the ever-increasing range of their application, and, indeed, it is almost surprising to see so large a list made up with particulars of manufactures in which asbestos is the principal constituent.

The list deals, we should think, with every possible use to which asbestos for engineering and kindred purposes can be put, and would form a very useful *vade mecum* on the subject for an engineer's office-table. The illustrations are numerous and good, and, with the descriptive matter accompanying them, give a clear idea of the firm's leading manufactures, all the prices of which have been revised down to date.

With such an array of the firm's products before him, the steam-user will easily be able to find the article best suited, not only for his daily requirements, but to any special difficulty with which he may have to contend, the goods being adaptable to every variety of experience.

No eulogy of Bell's asbestos goods is needed from us; but we may perhaps draw the attention of our readers to a leaflet issued with the catalogue, in which the company warn customers from being imposed upon by unscrupulous middle-men who are daily offering imitations of their goods, and which, needless to say, always tend, in the end, to bitter disappointment.

The catalogue also contains the company's telegraph code, and this is rendered additionally useful by the code-word being put under each illustration and after the price of each article.

We would strongly recommend those of our readers who wish to keep themselves acquainted with the latest products in asbestos, to write for and keep one of these catalogues by them.

The Worthington Pumping Engine Company's Catalogue. London: The Worthington Pumping Engine Company, of 153, Queen Victoria Street, E.C.

The Worthington Pumping Engine Company have recently published a handy pocket-size edition of their catalogue of pumping machinery.

This small edition is a *facsimile* reproduction on a reduced scale of the company's well-known large quarto catalogue, and, like it, contains illustrations and particulars of all the latest productions in the way of steam-pumps and hydraulic machinery, as manufactured by the firm.

The productions of this firm are too well known to our readers to need any detailed reference to them here; but we may mention the fact that their present handy little catalogue contains some thirty-four illustrations of the various types of their manufactures. In addition to these general illustrations, two full-page illustrations are given, showing, in perspective, all the details and parts of, respectively, their regular pattern and piston-pattern pumps, and, if only for the sake of these latter illustrations, the book should be in the hands of all users of Worthington pumping machinery.

The last ten pages are taken up with much useful information, including tables of friction of water in pipes of various lengths; pressure of water at various heads; diameters, areas, and displacements of plungers; and, in conclusion, comes the company's telegraphic code.

Preparing for Indication. By Robert Grimshaw. New York: Practical Publishing Company.

This handy little manual should be in the hands of all those who, in the course of their practice, are called upon to indicate different types of engines.

The book is the only one of its kind that we remember to have seen, dealing as it does exclusively with "practical directions how to pipe up and hitch on" the indicator and its tackle to all forms of engines.

The illustrations (some sixty in number) show clearly how to attach the parts in the simplest manner, and so as to give the most correct results; and, speaking after a twenty-three years' experience with the steam-engine indicator, the author is of opinion that he has set forth the methods of dealing with all cases that may occur in ordinary practice, and in this opinion we, after a careful perusal of the book, concur.

There is one type of engine, however, which the author has omitted to deal with, and we will give his own words for "making but one exception." He says: "There is in the city of Chicago a double oscillating engine, with variable stroke. I was sent for from New York to indicate this engine, which 'stumped' me for half a day. I got the cords, but forget how, and do not wish to remember."

Miscellaneous.

The screw tug *Slambi-Campbell*, lately launched from Messrs. Steward & Latham's South Dock Iron Works, went on her official trial on Tuesday, October 16th, when most satisfactory results were obtained. This vessel is built to the order of the Glengall Iron Works for service at Buenos Ayres, and will go out under her own steam. Her dimensions are:—Length, overall, 80 ft.; between perpendiculars, 75 ft.; beam 16 ft.; depth, moulded, 8 ft. 6 in. She is very strongly built of steel, under Lloyd's special survey for the 90 A class, with spacious and well-ventilated cabins both forward and aft, for an extra number of hands; the companions, skylights, &c., are of teak. The engines are of improved type of triple-expansion with three cranks, cylinders 10 in., 15¼ in., and 25 in., and stroke 18 in.; working pressure 150 lbs. per square inch. She is provided with extra large bunkers, which, together with the small consumption, will enable her to go long distances without recoaling. The steering gear, towing gear, windlass, &c., are of the most approved description for manipulating by hand, the whole of the work having been executed in a substantial and first-class manner. On her trial the average speed was about 10 knots, the engines running at 130, with a vacuum of 25 lbs.

A Quick Atlantic Run.—A correspondent writes from Rimouski, August 24th:—"Atlantic travelling has become quite a race between the great steamers, and many quick passages have been recorded between Queenstown and New York. The *Parisian*, the largest and best boat of the Allan Line, which arrived here to-day under the command of Captain W. H. Smith, R.N.R., has beaten the record, so far as time between land and land is concerned. After taking in the mails at Moville on Friday, the 17th, the journey to Quebec was commenced at 5 p.m., Tory Island being passed at 8.35 p.m. On Saturday the weather was delightful, but Sunday, Monday, and Tuesday were more or less wet. The sea was calm, however, and the boat was able to well maintain between fourteen and fifteen knots for the whole voyage. At 1.45, on Wednesday, Belle Isle was passed, and the captain was able to announce that the Atlantic had been crossed, from land to land, in 4 days 17 hours and 10 minutes. This—I am writing from the ship—is said to be the quickest run ever made across the Atlantic, from land to land. There were in all 818 souls on board, the passengers including Sir Alexander Campbell, Lieutenant-Governor of Ontario, the Hon. Mr. Mowatt, Premier of Ontario, and the Bishop of Rupert Land."

The Nelson Dock and Patent Slip at Rotherhithe was sold for £8,650, by Mr. Bradshaw Brown, on the 10th inst., and some adjoining wharf land was offered, but not sold.

The fourth blast furnace at the Dudelange Basic Steel Works, Luxemburg, is being lined ready for blowing in. During the month of August these works sent 3,000 tons of 4-in. steel billets to America.

The Naval Construction and Armaments Company at Barrow have received orders to build two steamers of 4,000 tons each for the Pacific Steam Navigation Company. They have already in hand two other large mail steamers for the same company. The Whitehaven Shipbuilding Company have also received orders to build a sailing ship of 2,200 tons. Other orders are pending with the Armaments Company at Barrow.

Shipbuilding Appointments.—Mr. James J. Peck, manager to Messrs. Napier, Shanks & Bell, has been appointed manager to Messrs. R. & H. Green, shipbuilders, Blackwall, London. We are informed that Mr. White, one of the managers of Messrs. Armstrong, Mitchell, and Co., of Newcastle-on-Tyne, has been appointed manager of the shipbuilding department of the Fairfield Shipbuilding and Engineering Company at Govan, and will have a seat at the Board. The London and Glasgow Engineering and Iron Shipbuilding Company (Limited) have appointed Mr. J. W. Shepherd, late manager of the Fairfield Shipbuilding Company, to be general manager in place of Mr. D. Kinghorn, resigned.

Sale of the Manx Liners "Victoria" and "Prince of Wales."—The Isle of Man, Liverpool and Manchester Company, of which Sir William Pearce, Bart., is the chairman, has, we understand, sold the two steamers *Prince of Wales* and *Victoria* to the old Isle of Man Company for £140,000, and thus will close the competition for the traffic which has been so serious to both companies. The two vessels were built early in 1867, and owing to their speed attracted much attention. They were each 340 ft. long, 39 ft. broad, and 24 ft. deep (moulded to upper deck). Their engines, of the compound type, had cylinders 61 in. and 112 in. diameter respectively, and the speed attained on the passage was over 20 knots. They were finely fitted internally.

The Boilermakers' and Iron Shipbuilders' Society.—Mr. R. Knight, the general secretary of the above society, states in his monthly report that the returns for the month show a better state of things than had been observable since 1883. There was no necessity now for booking contracts without good prices being secured by shipbuilders. There was undoubtedly a great scarcity of tonnage; freights had gone up considerably, and were still going up. The increased demand for steel and iron for shipbuilding purposes had raised the price per ton considerably, and the increased demand for workmen must have the same effect, and shipbuilders in estimating for new vessels must take these two factors into account. "We here give our employers," says the report, "a preliminary notice that a further advance of wages will be asked for at no distant date, as reductions of wages took place during the depression, which employers must be prepared to give back." Taking the whole field of shipbuilding throughout the United Kingdom, increased activity prevails, and the tonnage booked during the past month has been very considerable.

Dunbar and Ruston's New Dredgers.—According to the "Contractors' Chronicle" the Lubeck excavator at the Manchester Ship Canal is entirely beaten by Dunbar and Ruston's new dredgers, each of which lifts two yards of stiff clay at a single operation. The best the Lubeck machine can do is to fill 600 wagons daily with silt or similar soft material, whilst one of the Dunbar and Rushton's machines, working on very stiff clay, has filled 557 wagons, and on another occasion 640 per day, representing upwards of 2,500 tons.

Scotch Coal for the Navy.—Messrs. William Black and Sons, Glasgow, have just received an order from the Admiralty for about 1,000 tons of the navigation steam coal which they work at their Slamannan collieries. The coal which is to be supplied is intended for the use of the Channel Fleet, which is shortly to visit the Clyde, and is the same as they sent to Portsmouth some time ago for the trials of Scotch coal there. It is highly probable that such coal will henceforth be used in all ships of the Royal Navy when in northern waters.

Sale of Coasting Vessels.—Quite a number of coasting vessels have just changed hands. The *Fitzmaurice*, an iron steamer of 474 tons, built at Dumbarton in 1875, has been sold by Messrs. Burrell & Son, Glasgow, to Messrs. J. & W. W. C. Smith, Glasgow, for about £3,750. The trustees of Wingate Birrell's estate are disposing of Messrs. Hay's boats. *Strathspey*, of iron, 221 tons, built at Paisley in 1879, has been bought by Messrs. M'Gowan & Lane for £2,500. *Electric* has also been sold, and the *Magnetic* is "in close treaty." The *Camel*, of 356 tons, belonging to Messrs. Harland & Wolff, Belfast, has been purchased by Messrs. Matthew & Luff, London, who have also bought the *Orleans*. The *Shark* has been sold by Messrs. Burnett and Dalzeill to Mr. Joseph Fisher, Newry.

The Royal Yacht "Alberta."—It has been found necessary to make an important alteration in the *Alberta* at Portsmouth. The Royal yacht was launched at Pembroke as far back as October, 1863, when she was engined by John Penn & Son. During late years, either through the addition of extra weight on board or a change in the shape of the vessel itself—a misfortune to which all wooden hulls are liable under excessive strains—the immersion of the yacht in the water has been so much increased as to seriously handicap the engines. In paddle steamers it is not deemed expedient to sink the paddles more than one-third of their diameter, and as this has been exceeded in the *Alberta* to such an extent as to produce appreciable waste of engine power, it has been determined tentatively to reduce the depth of the feathering floats by taking about 7 in. from the outer edge.

A Long Run with Triple-expansion Engines.—A noteworthy example has just occurred on board the steamship *Matabele*, belonging to Messrs. J. S. Rennie and Sons' line of steamers to Natal, the engines of which vessel ran the whole distance from Portland, Dorset, to Natal, 6,700 miles, without a single stoppage or hitch of any kind. The engines are of the Triple-expansion type, built by Messrs. Hall, Russell, of Aberdeen, in 1885, and the vessel is completing her eighth voyage. The time occupied was 31½ days.

Extensive Boat-building Contracts.—Consequent on the revival of the shipbuilding trade, many others of minor importance, but immediately connected with its prosperity, are sharing in the good time at last come after several years of great depression. Messrs. D. White and Co., Eaglesham Street and Govan Road, Glasgow, have at present on hand twenty steel lifeboats for steamers owned in Germany, eight steel lifeboats for East India, and six steel lifeboats for Africa, and nineteen teak and yellow pine ships' lifeboats and cutters for steamships. On Thursday they launched four of these into the harbour for a steamship in Queen's Dock. Messrs. White & Co., the oldest established boat-building firm in the city, were the first to introduce steel into the construction of lifeboats on the Clyde.

Shipbuilding Contracts, Greenock.—Messrs. Rankin & Blackmore, engineers, Greenock, have secured an order to supply a set of patent quadruple-expansion engines of 1,000 I.H.P. for a steamer presently in course of construction by Messrs. Robert Duncan & Co., shipbuilders, Port Glasgow. The steamer is one of 2,500 tons, which is being built to the order of Messrs. Raeburn and Verel, shipowners, Glasgow.

Messrs. Gourlay Brothers & Co., Dundee, have contracted with Messrs. W. Johnston & Son, Liverpool, to build a large cargo steamer of nearly 6,000 tons deadweight. This will be the largest steamer ever built in Dundee.

Life-saving Appliances Exhibition.—Some of the members of the Royal Commission on Saving Life at Sea have visited the Alexandra Palace to inspect the valuable inventions collected there in the Life-saving Appliances Exhibition.

The Explosion at Calais.—"Calais," says the correspondent of the *Standard*, writing on October 17th, "has been the scene of great excitement throughout to-day, owing to the explosion on the steamer *Ville de Calais* in the dock between the railway station and the little village of Baraque, a few minutes after nine o'clock last night. The *Ville de Calais* was a new vessel, having been built at Newcastle-on-Tyne about twelve months ago, and was 1221 tons register. She was engaged specially in the petroleum trade between Calais and New York, and she was specially fitted with tanks and tubes for carrying the oil. The vessel lay at the end of the dock, scarcely a hundred yards from the petroleum reservoir which is erected on shore, and has the appearance of a gasometer. Yesterday she completed the discharge of her cargo, and was to have left this morning for Newcastle, for the purpose of having some improvements made in her machinery.

"At the time of the explosion water was being pumped into her ballast tanks, and it is supposed that the explosion was caused by one of the engineers taking a naked light into the hold of the ship to examine these tanks, the light communicating with the gas which had generated from the petroleum. The hatches of the vessel were all enclosed, so that the gas was confined. This, doubtless, accounts in a great measure for the violence of the report of the explosion, which was so terrific that it shook the ground for five or six miles round Calais. The greatest excitement prevailed in Calais throughout the night. People believing that an earthquake had occurred, left their houses in terror, and made their way towards the docks where many thousands of people assembled. The streets for several hours were in a state

of panic. Bugles were sounded, and the soldiers and pompiers turned out, the former marching down to the quays with fixed bayonets to keep back the crowds.

"The effects of the explosion are visible, more or less, in every part of the town. Windows are smashed in all directions, and in some cases large plate-glass windows have been shaken out of their frames. Windows are broken even in the fishing quarter of the town, and in the Fort Ribbon, near the entrance to the harbour; but in the neighbourhood of the dock there is hardly a whole pane of glass to be seen. The railway trains which were standing in the station and on the sidings present a very strange appearance. There is not a sound pane of glass in the carriages and sleeping cars, and some of the carriages appear to be otherwise damaged. The vibration caused by the explosion was felt very much at St. Pierre, near Calais, where some windows were broken, and there was very soon a stampede of people towards the scene of the disaster, attracted by the flames, which lit up the country for miles round.

"The wreck of the *Ville de Calais* presents a remarkable appearance. The crew numbers altogether twenty-six hands; but, at the time of the explosion, only about ten persons were on board. The captain, with his wife and another lady, were in their cabin, in the after-part of the steamer, which remains almost intact in a very remarkable manner. The captain stated that he did not imagine anything so serious had happened; but, when they went on deck, the ladies fainted at the terrible sight presented to them. The rest of the ship, with the exception of a small part of the forecastle, was blown into the air, and scattered in all directions. The sides of the vessel was blown clean away. With only a few feet of water in the harbour this afternoon, all that could be seen of the vessel are the stern to the extent of about one-fourth the length of the ship. From this point nothing can be seen except the bow, a few feet of which stand up. The force of the explosion was so great, that the hull of the vessel was shattered, and huge pieces of machinery were hoisted up in an extraordinary manner. A piece of iron-plating fell through the roof of a house at Baraque, and large pieces were blown to almost incredible distances. The iron plates appear in some cases to have been torn into fragments, and are strewn about the quays in all directions.

"Some pieces of machinery, weighing many tons, have been hurled a thousand yards or more. A tug and another steamer lying on the other side of the dock were struck with pieces of the iron plates.

"Almost simultaneously with the explosion a huge cloud of black smoke and *debris* ascended into the air, and burst into a straight column of flame of enormous height, the length of which was not perceptibly diminished for several minutes. The hull of the vessel where the explosion occurred was a mass of flames, which licked out on to the water, and were not extinguished until early this morning. The dock was full of shipping, most of the vessels being timber-laden, while the whole of the quays were crowded with timber, and the greatest anxiety was felt lest the fire should extend."

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from September 14th to October 18th, 1888.

13280 C. Sibley. Torpedo boats.
13287 J. M. Casswell. Propelling ships, &c.
13296 C. Merington. Shell or other projectile.
13317 S. W. Allen, J. Platt & J. Fielding. Transhipping coal.
13322 J. L. Corbett & J. L. Crawford. Increasing buoyancy of vessels afloat.
13334 J. Fielding. Hydraulic ship cranes.
13349 H. Gourlay. Steam boilers.
13356 E. Doubtfire, G. Webster & A. Jackson. Engine pistons.
13364 J. E. Slack. Purified water-feeder for steam boilers.
13374 T. Blanford. Steam boilers.
13383 J. E. L. Ogden. Steam engine piston and piston valve.
13388 J. Murrie. Water-feeder for steam boilers.
13434 J. S. Roake. Cleaning apparatus for steam boilers.
13442 F. Smith. Steam engine governor.
13450 E. Davies. Pistons.
13453 A. & W. Saunders. Load-line gauge for ships.
13457 J. C. Robertson. Rotary engines.
13465 H. J. Robson. Floating apparatus for saving life.
13466 J. D. Churchill. Piston packing rings and pistons.
13482 Bolt (Aron Hoorebeke). Floating ironclad disappearing turrets.
13486 Lake (E. G. Shortt). Steam and other engines.
13506 C. A. Knight. Feed-water heaters and condensers.
13512 J. Goudie. Propelling and steering ships.
13527 Stevenson (A. Lacanan). Sound-signalling at sea.
13549 H. H. Grenfell. Aiming or directing ordnance.
13550 E. T. Lambert & E. J. White. Taps or valves.
13557 J. S. Warburton. Pumps.
13560 J. A. Rowe. Water gauge fittings.
13578 J. F. Hall & C. H. Morton. Anchors.
13582 E. Lones & B. A. Webb. Pressure reducing valve.
13586 T. W. Baker. Valves and valve gear of steam engines.
13601 H. Gourlay. Steam boilers.
13612 E. Davies. One-cylinder compound engines.
13624 H. S. Maxim. Tempering and toughening of ordnance.
13642 H. Foster. Crank shafts.
13656 C. F. Hengst. Smokeless safety gunpowder.
13666 E. Mertz. Cooling the air in ships, &c.
13672 C. D. Wooley. Auxiliary rudder for vessels.
13684 A. Kaiser. Retaining valves.
13685 Ditto. Pressure reducing valves.
13726 G. Paley. Lubricating apparatus.
13731 E. H. C. Oehlmann. Pumps.
13744 J. Hailwood. Motor or engine.
13750 R. Jahr. Steam boilers.
13758 T. Nordenfelt. Shrapnell shells.
13775 J. H. Orr. Lubricators.
13776 T. W. Bayes. Feed-water heaters.
13781 Redfern (E. J. Woolf & J. F. Williamson). Valve gear for engines.
13782 J. & R. Wolf. Boats.
13789 Justice (L. Fraenckel). Explosive compound.
13790 A. Feldbacher. Boiler shells.
13791 Lake (The American Carrier Rocket Company). Rockets for life-saving purposes.
13801 H. T. Wright. Life boats.
13802 H. W. Wells & A. Solmans. Centre board for vessels.
13803 W. T. Smith. Breech-loading ordnance.
13813 Boult (H. Hurdle). Steam and other engines.
13832 W. R. Pether & R. W. Papineau. Feed-water governor.
13840 H. Williams. Forced draught in the furnaces of marine steam boilers.
13844 G. Lawson. Lowering concrete for sea walls, breakwaters, &c.
13851 W. Webster. Heating and purifying water.
13854 J. L. Corbett & J. L. Crawford. Saving life at sea.
13855 Ditto ditto. Covering apertures in ships, made by collision, &c.
13858 A. Ball, jun. Equilibrium valve.
13879 A. Howatson. Heating feed-water.
13885 R. Sickel. Consuming smoke in steam-boiler furnace.
13886 G. Torry. Furnace grates.
13945 H. Middleton. Submarine ships.
13963 S. Saunders. Tubular boilers.
13981 F. Silas. Distributing oil on water from buoys.
13982 Ditto Distributing oil over waves.
13988 F. W. Walker. Pumping-engines.
13992 Thompson (F. A. Tallendeau). Utilising exhaust steam for heating feed-water, &c.
14002 T. Wingate & L. Burnet. Steam boiler.
14025 E. J. Millett. Governor for marine and other engines.
14055 G. Lansell. Propelling vessels in water.
14056 Ditto Constructing ships and other vessels.
14066 H. Macaulay. Range finding.
14068 M. Immisch. Propeller shafts of vessels.
14086 J. Pain. Signals for preventing collisions at sea.
14106 H. Gourlay. Multiple-expansion steam engines.
14116 P. Haures. Steam boilers.
14118 J. I. Hemmingway. Piston rings and packing.
14133 Lake (G. W. Brown & C. D. Mosher). Producing artificial draught in steam boiler furnaces.
14142 J. Kirkman. Stuffing-box packing.
14145 J. F. Smith. Propelling ships, &c.

14157 J. Grange. Preventing radiation of heat from boilers.
14170 H. D. Hodgeman. Wheel worked in or by water, steam, &c.
14178 S. R. D. Mundy & W. J. Trowell. Lifeboats, &c.
14193 J. Horsfall. Slide valves of steam engines.
14208 W. B. Brown & J. Loughran. Cable traction for towing upon canals, rivers, &c.
14213 J. R. Fothergill. Pressure-reducing valve.
14216 J. H. Dales. Steam engine governor and expansion gear.
14229 C. J. F. M. Lilliehook. Fuses for shells.
14236 J. B. Prudhon. Steam boilers.
14257 N. E. Porter. Stowing ships' boats.
14264 E. S. Booth. Boiler-tube cleaning apparatus.
14265 A. McLaine. Heating and purifying feed-water.
14300 C. Saunders. "Trimming" coal in ships.
14310 F. W. Richardson. Air-propeller for steamships.
14324 J. Gordon, jun. Methods of recording adapted to anemometers, &c.
14325 J. Gordon, jun. Anemometers.
14326 Ditto Ships' logs.
14337 C. Wells & C. J. R. Stirling. Screw propellers.
14348 Imray (F. C. Glaser). Valve gear.
14361 W. H. Wood & A. W. Turner. Boilers.
14373 J. Joly. Obtaining soundings.
14374 T. M. Grant & A. Kelly. Steering, hauling machinery for ships.
14381 A. G. Mumford & J. Dalby. Valve gear.
14388 H. K. Toll. "Collision avoiders" for steamships.
14403 J. O. Holt & F. Venton. Ships' berths.
14415 C. E. Basevi. Circulation of steam by pressure-condensing engine.
14432 J. Horn. Furnace for steam boilers, &c.
14447 A. H. Walker. Sea-oiling projectile.
14450 J. J. Pearson & T. H. Taylor. Double-acting pump.
14462 P. Robertson. Boring rudders and stern frames of vessels.
14485 J. Sawyer, H. B. Phillips & W. Mitchell. Steam boilers.
14520 W. Gardner. Screw propeller.
14571 H. Petersen. Ships' propeller.
14590 J. H. Milne. Propelling and steering ships.
14599 Binks (J. Binks). Preventing deposit or incrustation in boilers.
14602 J. Fielding. Breech mechanism for ordnance.
14612 J. Monteith. Marine telpherage system.
14616 M. Hecking. Centrifugal pumps.
14640 H. Grafton. Steam and other engines.
14641 J. Rogerson & A. Downie. Working rapid-firing guns.
14646 H. P. Parkes & J. Hartness. Anchors.
14657 J. Davies & T. Walmsley. Furnace grates.
14714 A. Ridge. Valves and valve gear.
14722 J. F. Humphrey. Propellers for steamships.
14736 G. & S. T. Ainsworth. Lubricator.
14741 T. Pease. Propulsion of canal boats, &c.
14759 Murrison (J. Christie). Single and double acting pumps.
14771 R. A. P. Taunton. Manufacture of steel shell projectiles.
14778 G. G. Rhodes, J. S. Critchley & C. Cole. Triple-expansion engine.
14790 B. A. Dougherty. Detection of fire on ships, &c.
14794 W. G. Nixon. Metallic packing.
14816 A. Reis. Pumps.
14817 T. Fox, J. R. Fothergill & D. B. Morison. Boiler furnaces.
14818 G. Kilgour. Range finders.
14823 H. H. Westinghouse & F. M. Rites. Steam engines.
14832 G. F. Gallaher. Furnaces.
14852 C. Johnson. Piston.
14874 Thompson (G. Zara & E. Riva). Balanced slide-valves.
14880 C. J. Galloway & J. H. Beckwith. Heating feed-water for steam boilers.
14902 R. E. Ellis & P. McAlister. Life and other boats.
14911 J. Broady. Lifting sunken ships.
14928 J. Gilmour. Supplying fresh water to boilers.
14931 E. Paul. Evaporating water and heating feed water.
14939 E. D. Tovee. Consuming smoke in boiler furnaces.
14951 W. S. Melville. Deck "water-delivery ports" of vessels.
14952 J. Dewrance & G. H. Wall. Water gauges for boilers.
14966 P. Harvey & W. Harris. Admission of steam to steam-steering engines.
14971 O. Zwiest. Heater and steam generator.
14976 G. Glover. Engines.
14987 R. R. Hutchinson. Steering apparatus for ships.
14993 J. Shepherd. Boiler tubes.
15001 G. H. Kendall. Light feed-lubricator.

BOARD OF TRADE EXAMINATIONS.

EXTRA FIRST CLASS.

October 13th, 1888.	Carlton, T.	Extra 1C	N. Shields.
,, ,, ,,	Pitt, F.	,, 1C	,,
,, ,, ,,	Wray, T. W.	,, 1C	,,
,, 19th ,,	Black, W.	,, 1C	London.
,, ,, ,,	Smith, A. W.	,, 1C	,,

NOTE.—1 C, denotes First Class; 2 C, Second Class.

September 22nd, 1888.

Campbell, Robt.. 1C Liverpool
Campbell, W. H. 2C Dublin
Caskie, James .. 2C Cardiff
Curry, H. Rees.. 2C N. Shields
Davies, W. J. P. 2C Cardiff
Evans, John N... 1C ,,
Fraser, John.... 2C Glasgow
Gamblin, Joseph 2C N. Shields
Gonzalez, Jose M. 2C Dundee
Harkess, Wm. .. 1C Glasgow
Hughes, John .. 1C ,,
Hunter, John W. 2C ,,
Hunter, Wm. H. 2C N. Shields
Kemp, Frank .. 2C ,,
Logan, George.. 1C Glasgow
Lord, Francis J. 1C London
McEwan, Thos... 2C Glasgow
McPhee, Duncan 2C ,,
Mowat, Jas..... 1C Aberdeen
Paton, Andrew.. 2C Glasgow
Pugh, William.. 2C Cardiff
Rogan, Wm. F. 2C ,,
Rogers, John H. 2C ,,
Sim, George .... 1C Aberdeen
Sommerville, A. 1C Glasgow
Stathern, John.. 2C London
Vile, W. J. .... 1C Cardiff
Wallace, J. C... 2C Glasgow

September 29th, 1888.

Atkinson, Martin 1C Hull
Carmichael, Jno. 1C Liverpool
Cope, James .... 2C ,,
Davies, E. H. .. 2C Hull
Davidson, J. A. 2C Sunderl'd
Donald, Martin . 2C Hull
Drover, Wm. P. 1C London
Duer, Jas. Saml. 1C S'th'pton
Edwards, Jno. T. 2C Liverpool
Groves, Wm. R. 2C Hull
Hands, Josiah .. 1C N. Shields
Kepple, Thos. H. 2C Sunderl'd
Kerr, Andrew .. 2C N. Shields
Matthews, John 2C Liverpool
McEwan, Chas. 1C ,,
McNaughton, J. 2C ,,
Meldrum, S. F. 1C Sunderl'd
Quenet, F. A... 1C ,,
Shuttleworth, G. 2C Liverpool
Sinclair, Russell 1C London
Speak, Thos. J. 2C Liverpool
Stromberg, A. W. 2C Sunderl'd
Thornber, W. A. 1C Liverpool
Wolfenden, R. W. 1C London

October 6th, 1888.

Bain, Wm. .... 2C Glasgow
Brough, J. T. .. 2C London
Buchan, John .. 2C ,,
Burn, Thos. C... 1C Leith
Cornelius, Saml. 1C Cardiff
Davidson, J. G. 2C Glasgow
Davies, David .. 2C Cardiff
Dickinson, James 2C N. Shields
Elder, Alex. D. 2C Glasgow
Evans, Chas. Geo. 2C Cardiff
Glass, Thos. .... 2C Glasgow
Henderson, D. S. 2C N. Shields
Honstein, Jean F. 1C Leith
Langham, Hy. J. 2C London
Mabe, Edwin .. 1C Cardiff
Middleton, David 2C Glasgow
Millar, Berwick 1C Leith
Morrison, John.. 1C Glasgow
Orrin, Chas. .... 1C Cardiff
Payne, George .. 2C Glasgow
Robertson, W. D. 1C ,,
Ross, John .... 2C Leith
Russell, Thos. W. 2C N. Shields
Scott, Ralph.... 1C ,,
Schuler, Robt. .. 1C Cardiff
Stephens, J. W. T. 2C ,,
Stewart, James.. 2C Belfast
Tubbesing, H. B. H. 1C Leith
Whitton, Fredk. P. 2C ,,

October 13th, 1888.

Almond, Walker 1C Greenock
Anderson, John .. 1C ,,
Aspinall, H. W. 2C London
Blount, W. V... 2C ,,
Carey, De Lisle.. 1C N. Shields
Davies, Jno. P. 1C London
Drake, Stephen B. 2C ,,
Ewart, Geo. R... 1C N. Shields
Henderson, J. A. 2C Dundee
Heron, Wm..... 2C Greenock
Hughes, John .. 2C Liverpool
Hunter, John .. 1C ,,
I'Anson, J. W. 1C Greenock
Kitching, Alfred 1C Liverpool
Leach, T. A. W. 2C ,,
Lloyd, Edwd. T. 1C ,,
Macdonald, Paul 1C ,,
Massie, Wm..... 2C ,,
McBride, Chas. 2C Greenock
Miller, Thos. B. 2C N. Shields
Powell, Robt. .. 2C Liverpool
Reid, Wm. E. .. 2C Dundee
Richardson, O. R. 1C N. Shields
Ridley, Wm..... 1C London
Ringrose, A. W. 1C N. Shields
Ritchie, David .. 1C Liverpool
Salkeld, Joseph.. 1C N. Shields
Saunders, E. W. 1C Hull
Scott, Fredk. J. 2C Liverpool
Scott, R. M..... 1C N. Shields
Stather, Wm. H. 1C London

ENGINE CONTRACT FOR PAISLEY.—Messrs. Fleming and Ferguson, engineers and shipbuilders, Paisley, have secured a contract for the construction of six sets of their patent quadruple-expansion engines for steamers for South America.

The Marine Engineer.

LONDON, DECEMBER 1, 1888.

LORD MACAULAY'S imaginative word-picture of a New Zealander standing on London Bridge and gazing on the ruins of St. Paul's Cathedral is not likely to be realised for many ages to come. But unless the directors of the Caledonian Railway Company do something, and that promptly, to secure a greater sufficiency of water from the Firth of Forth to their docks at Grangemouth, it is quite possible that at no distant date some brawny Scotchman will be discovered weeping over the fate of a port which might, with its natural advantages, have become the largest on the east coast of Scotland. About twelve years ago Parliament granted the above-mentioned railway company permission to construct new docks at Grangemouth, and six years afterwards they were opened with the usual flourish of trumpets. Since that time dredging operations have been carried on with a view to increasing the depth of water in the river Carron from 21 ft. to 25 ft., but all to no purpose. Two years ago the shipowners and merchants were alive to the unfortunate situation of affairs, and a meeting was held to consider what steps should be taken to urge upon the railway authorities the great necessity of adopting an alternative plan to secure the desired effect, but the directors "did nothing in particular, and did it very well," in reply to the appeal. Since then the state of affairs has become so critical that another mass meeting has been held, presided over by Provost Mac pherson, a shipping magnate of the port. A large number of letters were read to the assembly, proving conclusively that there were all the elements of expansion and development at this port, which, if taken advantage of by the railway company, would secure to them a healthy dividend. But at present replies to frequent inquiries as to what the depth of water would be at Grangemouth on certain days lead to vessels going elsewhere owing to insufficiency of water. A great many steamers have proceeded to Alloa with grain, principally from the Baltic ports, but they had, however, to be partly lightened before they could get so far up as Alloa, whereas if the statutable depth of water at Grangemouth had been secured the railway company would have enjoyed the benefit of these vessels entering into their own docks. There is one crooked corner in particular in the river Carron which shipowners do not appreciate, because it is full of stones! Tugs have to be used for steamers, and this is an expense that is grudged very much. Many large steamers arrive in Kincardine Roads with esparto grass, but they give Grangemouth the "go-by" owing to the cause before mentioned. Among the several letters read at the indignation meeting referred to, one from Messrs. James Gardiner and Co., shipowners and shipbrokers, Glasgow, and which has been forwarded to us, will doubtless suffice to prove how trade is daily leaving Grangemouth through the stupidity of the railway company. It runs as follows:—"We have been in the habit of loading our steamers—*Moidart*, *Morven*, and *Arisaig*—at Grangemouth for Baltic ports. The first-named steamer draws about 18 ft., the others about 16½ ft. Owing to the insufficient depth of water we have for some time refrained from sending the *Moidart* there, and even with the other two steamers the risk of detention is so great, and the possibility of accident is such, that we have almost decided to bar Grangemouth altogether. Grounding in the cut is no doubt attended with little risk, but it might very easily place an owner in an awkward position if his steamer foundered on the outward passage. While this is the case, Grangemouth does not offer any higher freight to compensate for the risk. With greater depth of water we see no reason why steamers of 3,000 or 4,000 tons should not be attracted there. For instance, we have a steamer due at Dundee next month with a cargo of jute from Chittagong. We could get a suitable coal freight for her from here to Bombay, which would suit us very well, but of course we could not ship the steamer so far for it. There would be nothing to hinder the coals being loaded at Grangemouth if there were sufficient water for her. No doubt with many other cargoes, not only of coals, but also of pipes and general cargoes, the position is the same. The difference in transit, we are sure, is not such as to prove a serious obstacle, and if only sufficient depth of water were provided we would look for a considerable development in such business at Grangemouth. *Arisaig*, s.s., loaded at Grangemouth last month and lay a tide in the cut, and on her arrival at London a fortnight ago we felt bound to dock her, although she had been docked and painted three months ago at great expense, as she had to load a valuable general cargo in London, and any question of unseaworthiness would, in the event of loss, have been ruinous." With such-like facts looking them in the face, coupled with a large increase of business since the docks were opened, despite the disadvantages indicated, the directors of the railway company hesitate to make a canal from the deep water of the Firth of Forth direct to their docks at an estimated cost of £150,000. The Provost explained to the meeting that had ther

been 25 ft. of water during the past four years, at least 1,000,000 tons of coals would have been shipped, besides a large quantity of other traffic. The result was a loss to the railway company, in the shape of harbour and railway dues, of £80,000 annually. In other words, the proposed canal would have been constructed and paid for ere this. The interests of the company and shipowners are for once identical over this matter, yet the latter are being materially hampered in their business owing to the indolence of the former. Unfortunately, the shipowners, merchants, and traders of Grangemouth are at the mercy of this supine railway company, inasmuch as the Grangemouth Harbours Act of 1876 is so loosely worded that the proverbial "carriage and four" can comfortably drive through it. Certainly, Clause 4, Section 9, of the Act provides for "the dredging, deepening, and improvement of the navigation of the river Carron so that the navigable channel thereof *shall* be of the depth of not less than 25 ft. at high water of spring tides from the termination of the said entrance out to the river or Firth of Forth." But, practically speaking, other provisions in the Act transmute the "shall" into "may." When Acts of Parliament are not framed ambiguously, then we may expect the millennium. In the meantime, it is devoutly to be hoped that the Legislature, in granting privileges to railway and other companies to construct docks, will not only clearly set forth what is to be done, but see that the provisions of the Acts are faithfully and honourably carried out.

THE North-East Coast Institution of Engineers and Shipbuilders have had a most successful visit to Hartlepool, and the evening was rendered interesting by the communication of an important paper from Mr. John Price, General Manager of Palmer's Shipbuilding Company, on the use of machinery in construction. The author gives us many interesting facts, gathered from the statistics of his many years of practical experience, as to the percentage of hand labour and machine labour used in ship and engine building. He credits the use of machinery in construction with three objects to fulfill, namely, accuracy in execution, facility in production or repetition, and cheapening of cost. This, however, is produced without detriment to skilled or unskilled labour. It is found that the percentage of labour to selling cost of work produced is higher now than it was 15 years back, but a much larger proportion of work is produced at a cheaper price, giving us more and more the control of foreign markets as the system of special machinery is amplified. It is therefore desirable that labour should recognise machine tools as serving their purposes in the constant providing of good wages, whilst, at the same time, serves the purpose of the employers in giving them a larger market for their goods. Mr. Price finds that, taking 1871 as a starting-point, there has been a steady rise in the cost of hand labour in almost all descriptions. He finds this to be equal to a permanent average increase, including day labourers, of over 21 per cent., pattern makers benefiting by as much as 38 per cent., fitters 29 per cent., and smiths 27 per cent. During the same time the general work and value of the marine engine and its boilers has risen about 35 per cent., caused by, first, the change from injection condenser types to the surface condenser type, and, secondly, in passing from the latter to the triple-expansion type; but yet, notwithstanding the increased cost of labour as above, and the enhanced value of the engines and boilers, machine tools and our better modern system keep down the total cost to-day to less than total cost fifteen years ago. With regard to the total cost of machinery production, labour tends steadily to rise. The fall seldom or never reaches the average lowness that prevailed before the rise. The cost of the materials, however, on the contrary, tends downwards, through the same extension of better methods and machine tools in the preparation and manufacture of that material. As an example of the excellent effects to the working man eventually in the combination of skilled labour with modern machine tools, the author gives some interesting results as regards the development of business in his Company. Since 1873 the workmen, as a whole, have been enabled in ten years to produce double the horse power per man that was done before, but on the total there are 25 per cent. more hands employed at the present date than in the former date, while the production is more than double, the difference being made up by the present large proportion of work done by machine tools. This seems amply to confirm the exponents of free trade that the market extends with cheapness of production, and that this cheapness all round eventually tends to bring greater comfort to the greater number. In iron shipbuilding the adaptation of machine tools is as general as to the construction of machinery, with the drawback that the author complains that iron vessels are now-a-days constructed, as far as possible, on the same system as the original wooden vessels. This he regards as an entire oversight of the principles of economical construction, so that there is still a considerable struggle to be gone through to obtain the acceptance of a system of construction, combining all needful strength, with a more

reasonable distribution of the material, and a better command over the cost of production, by the use of machine tools. The time wages of all classes of men employed in shipyards have acquired a permanent average increase of 25 per cent., ranging from 11 per cent. to 38 per cent. according to the special departments. On shipbuilding averages it is found that from a percentage of labour of 24 per cent. to 30 per cent. as dating some fifteen years back, latterly the average percentage of hand labour has been at least 34 per cent., with a proportion of 36 per cent. to 38 per cent. on small vessels. Looking, then, at the whole subject, it is somewhat striking to note that the constant demand of the artizan for regularly increasing wages would by this time have paralysed production by too heavy a first cost, had not this tendency been counteracted by the introduction on the part of capital of machine tools to check that increased cost. The author, finally, is of opinion that, seeing that the foreigners have benefited by our experience in a realisation of the value of machine tools for cheapening production, we shall find ourselves subject to keener competition, year by year, from foreigners, unless workmen and employers alike heartily coact for the devising and operation of machine tools.

A good deal of dissatisfaction will be aroused among that important body of men in the Steam Reserve at Portsmouth, namely, the stokers, by reason of a late direction of their Lordships to make no special allowance for their victualling on shore. As at other ports, the leading and first-class stokers, who naturally include the oldest and men of best character, have hitherto enjoyed with the officers the privilege of victualling themselves on shore, receiving, in consequence, 1s. 1d. per day in the shape of compensation money. This allowance, which is only 2½d. in excess of the nominal value of their rations afloat, represents an important addition to their pay, and largely adds to the comfort of the family while the stoker lives on shore. The men of higher rating, who enjoyed this allowance, formed a class to which the men of the lower rating looked forward, and thus a distinct prize was offered to the men of lower rating, tending largely to the maintenance of discipline on board ship. A regulation has now been issued that an old three-decker, the *Marlborough*, is to be utilised for the purpose of victualling the men as at sea. This will surely place the Admiralty at an equal cost as heretofore, what with extra cooks, mess traps, and conversion of the vessel for the purpose, whilst it strikes at a large part of the income of the stoker and his family when he is a married man. It is asserted that 500 stokers are to be added next year to the effective strength of the navy. This is not before it is wanted, when, in spite of this considerable addition, the best authorities consider that it will not be sufficient to meet the present requirements of modern naval organisation in time of war. The steam department of the service, which has so long been regarded as the humblest, is rapidly becoming a primary necessity for the maintenance of a steam navy. So many of the operations are now conducted by machinery that it is the blue jacket, pure and simple, with his obsolete training and traditions, that is rapidly becoming the idler on board our new ironclad navy. It would appear that the blue jacket and the stoker, or engineer's labourer, must become convertible terms. In consequence of the abolition of masts and sails, and in the reduction of the number of guns carried, the complement of sailors is being decreased. The complement of stokers is, on the other hand, being increased, so that any change of regulations which may tend to make the reserve service unpopular is much to be deprecated, and is likely not only to diminish the ranks of the continuous service men, but will alienate the best candidates from entering. If it be possible without inconvenience to offer the advantage of a home to men returning from long commissions at sea, it is surely in the interests of the navy and of the country at large that this convenience should be granted.

Among the many operations of the drawing office there is probably not one where time is so much grudged as in the preparation of several sets of tracings from the same drawings. Now, to satisfactorily prepare several sets of tracings, in the time at one's disposal, is sometimes not only a great time consumer, but a physical impossibility, and hence it becomes necessary to employ some other means than the ordinary tracing routine.

Among the best of these means, and certainly we may say the best we have seen as regards simplicity, cleanliness, and clearness of result, is the new "Ferri-cyanide" direct positive paper, prepared by Mr. J. R. Gotz. This paper gives a sharp, crisp, blue line on a white ground, and for fullness and clearness of detail surpasses anything in the way of mechanical reproductions of drawings that we have seen.

The process of reproduction with this paper is as simple and clean as the results are good.

A tracing, preferably done on white paper, and having all its lines absolutely black, is laid on a sheet of the prepared paper and exposed to sunlight for one or two

minutes, or in a poorer light the time required may run to twenty minutes.

After printing, which may with this paper be done without trial slips, direct inspection being admissable, the print or paper is developed with a ten per cent. solution of red and yellow prussate of potash (each in equal parts) and after washing off the excess of developer in cold water, the print is completed, and may be sent out immediately it is dry. Thus, with a good light it is possible to perfectly reproduce the most intricate drawings, irrespective of size, in the space of only a few minutes, twenty or thirty copies being easily made in the course of a single morning.

Mr. Gotz, whose address is 19, Buckingham Street, Strand, W.C., will be pleased to show samples of work done with this paper.

THE LAW CONCERNING MARINE ENGINEERS IN CONNECTION WITH SHIPPING CASUALTIES.

(*Continued from page* 265.)

There are some very important points respecting the procedure of investigations into shipping casualties which are well worthy of the attention of marine engineers, and which we will now communicate. In the first place, all such inquiries are to be so conducted, that if an accusation is made against any engineer he shall have an opportunity of defending himself. After the witnesses for the Board of Trade have been examined, the Board is to declare in open court upon what questions relating to the causes of the casualty, and the conduct of any persons connected with such, they wish for the opinion of the court, and if any person whose conduct is in question is a certificated engineer they are also to mention in open court whether they think his certificate should be dealt with. It has been held that the court will not cancel or suspend an engineer's certificate unless the Board of Trade on the questions submitted to the court previously require it to be dealt with. It has been decided that an erasure in a log-book casts serious suspicion on it, and is thought to destroy its authority; therefore it should never be made. If it is wished to amend a mistake in this book it should be done by interlining, so as to clearly indicate what the original entry was. At the time and place appointed for investigating a shipping casualty the court may proceed to hear and determine the case, whether the parties upon whom a notice of investigation has been served, or any of them, are present or not. When the entire evidence is finished, the parties are to be heard in such order as the judge may direct, and the Board of Trade is to be heard in reply. The witnesses are to be cross-examined in such order also as the judge may require, and may be re-examined by the Board of Trade. Two investigations may be held together when the same engineer is concerned, even if the casualties occurred on different voyages. Unless the certificate of an engineer is cancelled or suspended, in which case the adjudication is always to be given in open court, the judge may pronounce the decision of the court either orally or in writing, and if in writing it may be sent or delivered to the respective parties, and it shall not be requisite to hold a court only for giving judgment. At the conclusion of the case the Wreck Commissioner, or other authority, is to report the facts of the same to the Board of Trade, and each assessor as well as the Commissioner must sign the report made on the investigation, or report to the Board of Trade his reasons for dissenting therefrom. When the certificate of an engineer has been cancelled or suspended, the Board of Trade is, on the application by any party to the proceedings, to give him a copy of the report made.

It is provided that when an investigation concerning the conduct of an engineer, or into a shipping casualty, has been held under the Merchant Shipping Act of 1854, or any statute amending such, or any provision for holding such inquiries in a British possession, the Board of Trade may in any case—and shall if new and important testimony which could not be produced at the investigation has been discovered, or if in their opinion for any other reason there has been ground for suspecting a miscarriage of justice—order that the case shall be reheard, either generally or as to any portion of such, and either by the court or authority by whom it was at first heard, or by the Wreck Commissioner, or in England or Ireland by a judge of the High Court of Justice exercising jurisdiction in Admiralty cases, or in Scotland by the Session Court ordinary, or any other judge in the Court of Session whom the Lord President of that court may appoint for that purpose, and there the case is to be so reheard accordingly.

Upon an investigation under Section 241 of the Merchant Shipping Act, 1854, before a local marine board at Shields, respecting the conduct of an engineer who, the master stated, had been intoxicated upon the voyage, the court found that the former had been drunk, but it was not satisfied that any loss had been occasioned by this misconduct, and, after reprimanding him, the court returned him his certificate. In this instance, the Board of Trade directed a re-hearing before the Wreck Commissioner sitting at Newcastle, who, having read the evidence, decided that the engineer had often been guilty of drunkenness while on board, incapacitating him for the discharge of his duties, and his certificate was therefore suspended. Upon a motion in the Queen's Bench Division for a rule for a *certiorari* to adduce the order of the Wreck Commissioner for the purpose of quashing it on the ground that he had no jurisdiction, inasmuch as no casualty had occurred, it was held that the Act empowered the Board of Trade to re-hear either in cases of misconduct or casualty, and the rule was refused.

Before the passing of the Shipping Casualty Investigations Act, 1879, there was no right of appeal in respect of the decisions pronounced upon inquiries into these casualties. According to Murton's "Wreck Inquiries," "while the Board of Trade retained the power to cancel or suspend certificates under the Merchant Shipping Act, 1854, they exercised it or not according to the view which they took of the facts and circumstances of the case reported to them by the court which had held the inquiry, and of the opinion of the court thereon. There was no power of obtaining anywhere a review of the finding of the investigating tribunal, although the Board of necessity deliberated on the case when the report was adverse to a certificated officer before dealing with his certificate. Upon the transference of the cancelling and suspending power to the investigating tribunal, authority was given to the Board to return a cancelled certificate, or issue a new one, or shorten the time of suspension, and for that purpose they had still to exercise to some extent the right to review. Except, however, as thus controlled, the decision of the court upon the merits was final, and the discretion of the Board itself was never open to question. The only method of procedure available to an aggrieved officer was by way of memorial to the Board of Trade to reconsider the matter....The Board of Trade, though deprived of its original power of cancellation or suspension, was thus in effect often a court of review in respect of punishment, but the power was only sparingly exercised. It was clear that the court which had tried the case, and had seen the witnesses, had the best means of forming a correct judgment, and except to redress manifest injustice, or to grant certificates of a lower grade, the decisions of the courts should not have been, and were not in fact, disturbed by the Board of Trade."

According to a return of appeals from the Wreck Commissioners Court to the Admiralty Division of the High Court of Justice, from the 1st Nov. 1879, when the statute authorising appeals came into operation, down to the end of Dec. 1884, out of 327 investigations held before the Wreck Commissioner, in seventy-seven of which the certificate of the master or officer was dealt with, the only appeals from the decisions of the Wreck Commissioner were four, of which one was abandoned, one affirmed, one varied, and one reversed. This statement says much in favour of the ability of this judge to hear and determine shipping casualty cases.

It is now provided that when a court of inquiry into a shipping casualty held under the 8th part of the Merchant Shipping Act, 1854, orders the suspension of an engineer's certificate according to the powers given by the 242nd section of the same statute and the 23rd section of the Merchant Shipping Acts Amendment Act, 1862, the Court of Appeal having jurisdiction under the Shipping Casualties Investigations Act, 1879, will consider on appeal the evidence on which the decision of the Court of Inquiry proceeded, and will reverse the adjudication if the evidence is inadequate to justify the suspension of the certificate.

The *Arizona* (49 L. J. P. D. & A. 54).—An appeal from a decision given in England in any inquiry as to the cancelling or suspension of the certificate of an engineer when no application for a re-hearing has been made, or it has been refused, lies to the Probate, Divorce, & Admiralty Division of the High Court of Justice. If the adjudication is given in Scotland, an appeal lies to either division of the Court of Session. If the judgment is pronounced in Ireland, the High Court of Admiralty is the appellate tribunal or the judge or division of the High Court of Justice exercising jurisdiction in Admiralty cases. If the decision is by a naval court, the appeal is to the Probate, Divorce, and Admiralty Division of the High Court of Justice.

The Court of Appeal is to be assisted by not less than two assessors, to be selected, in the discretion of the court, considering the nature of each case, from either or both of the following classes, namely:—(1) Elder Brethren of the Trinity House; (2) persons approved from time to time by the Secretary of State as assessors for the purpose of formal inquiries into Shipping Casualities under section 30 of the Merchant Shipping Act Amendment Act, 1876, and sub-section 1 of section 3 of the Shipping Casualties Investigations Act, 1879. The Court of Appeal may order any other person or persons, body or bodies, other than the parties served with the notice of appeal, to be added as a party or parties to the proceedings for the purposes of such appeal, on such terms with regard to costs and otherwise as the court deems proper.

The court is also empowered, on questions of fact, to receive further evidence, either oral, by affidavit, or by deposition taken before an examiner or commissioner. Testimony may also be given, by special leave of the appellate tribunal, concerning matters which have occurred subsequent to the decision in the Court below. On the conclusion of an appeal, the Court of Appeal is to send a report of the case to the Board of Trade, similar to that required to be sent by the Wreck Commissioner or other authority from whose adjudication the appeal is brought.

When a court of investigation, held under the 3rd part of the Merchant Shipping Act, 1854, suspends an engineer's certificate on the invitation of the Board of Trade, the Court of Appeal will, if the certificate has been wrongfully suspended, give costs to the successful appellant, unless he has been guilty of such misconduct as caused an investigation as to the suspension of his certificate necessary. Such deposit or other security for the costs which may be incurred by any appeal is to be made or given as may be ordered under special circumstances by the Court of Appeal.

ON THE HORSE POWER OF MARINE ENGINES.*

By Mr. Henry Dyer, C.E., M.A., Vice-President.

FOR a very considerable time past the question of the method of measuring the horse power of marine engines, for the purposes of registration, has been one which has led to difficulties between engineers and shipowners, and it has been discussed in scientific journals and before engineering and shipbuilding institutions, but so far without leading to any very definite results. The most serious attempt at a solution which has recently been made is that by the North-East Coast Institution of Engineers and Shipbuilders, a report of which has been issued by the Council of that Institution and circulated among engineers and shipbuilders.† A copy has been sent to the Institution of Engineers and Shipbuilders in Scotland, and the attention of the members is called to it in the hope that it may meet with their approval. When such a communication is received from a sister institution on such an important subject, it is advisable that an opportunity should be given to the members of expressing their opinion on it, and this paper has been prepared chiefly for the purpose of affording this opportunity. Before, however, taking up the special proposals made by the North-East Coast Institution, it may be well to briefly review the previous history of the question.

When steam engines began to supersede the labour of horses, it was convenient, both for the engineers and the purchasers of the engines, to have a standard for comparing the one with the other, so that an approximation might be made to the size of the engines required. Watt adopted as unit horse power 33,000 pounds raised one foot high in a minute. Smeaton had previously found that 22,000 pounds raised one foot high in a minute was about the average performance of a horse working eight hours a day, so that from the time of the introduction of the term horse power, the actual power was much greater than that given by the usual method of calculation. In the early engines the pressure of the steam rarely exceeded 7 pounds per square inch, and was very nearly uniform, while the piston speed averaged about 200 ft. per minute, so that the horse power was proportioned to the size of the cylinders. As improvements were made in workmanship and design, and as pressures and speeds increased, the actual power of the engines became much greater than that given by the ordinary rule, and to distinguish these two quantities the latter was called the nominal horse power, which was thus simply a commercial unit by which engines were bought and sold. As in the early days of steam engineering the practice of manufacturers was very nearly uniform, the nominal horse power was approximately proportional to the actual or indicated horse power, the term was convenient and useful, and thus came into general use.

The method of calculating the nominal horse power of engines, established by the practice of Boulton & Watt, was as follows:—The mean effective pressure of the steam was assumed to be 7 pounds on the square inch, and the velocity of the piston to be 128 feet per minute, multiplied by the cube root of the length of stroke in feet, then

$$\text{Nominal H.P.} = \frac{7 \times 128 \sqrt[3]{\text{stroke in feet}} \times \text{area of piston in sq. ins.}}{33{,}000}$$

$$= \frac{1}{47} \times \text{diameter}^2 \times \sqrt[3]{\text{stroke in feet.}}$$

This rule was applied to land engines. For the engines of paddle steamers a slight modification was made in the supposition for the speed of the piston. For the engines of screw steamers the fictitious value of 7 pounds on the square inch for the steam pressure was retained, but the real velocity of the piston was taken into account, so that

$$\text{Nom. H.P.} = \frac{\text{vel. of piston in ft. per min.} \times 7 \times \text{area of piston in sq. in.}}{33{,}000}$$

$$= \frac{\text{vel. in feet per minute} \times \text{diameter}^2 \text{ (in inches)}}{6000}$$

This rule was adopted by the British Admiralty, and was called the Admiralty rule.

If in Boulton and Watt's rule we assume the piston speed to be 200 feet per minute, then

$$\text{Nom. H.P.} = \frac{7 \times 200 \times \text{diameter}^2 \times \cdot 7854}{33{,}000} = \frac{\text{diameter}^2}{30},$$

that is, a nominal horse power was equal to 30 circular inches of piston area, and the total nominal horse power of a set of engines was obtained by finding the number of circular inches in all the piston areas, and dividing by 30.

This rule, or a modification of it, is still used to a large extent. Some years ago Mr. Parker, Chief Engineer Surveyor, and Mr. Milton, Engineer Surveyor, prepared for the information of Lloyd's Committee, a memorandum on the subject of nominal horse power, and they drew out a table giving some of the rules then in use, and to show the difference in the results which they gave, they calculated the nominal powers of three engines of different sizes. For the information of the members that table is reproduced in the Appendix to this paper, from which it will be seen that there is as great a variety in the results as in the shape of the formulæ, while the actual registered horse power seems to have been arrived at chiefly by a process of intuition. The authors of the memorandum remark that "on reference to this table it will be seen how much these manufacturers' rules differ; but not only do they differ amongst themselves, but on comparison with the Register Book it will be found that in very many cases the power registered by the owners of the vessels is as much as 20, 30, and even 40 per cent. in excess of the manufacturers' own rule, upon which the engines have been sold and paid for; whilst in other cases engines which would work out by their makers' rule as 110 and 120 horse power, are registered as 95, 98, or 99 horse power, in order to evade the requirements of the Merchant Shipping Act of 1861." They conclude the memorandum by saying, "after carefully considering the whole subject, we are of opinion that it is absolutely impossible to fix upon any rule whatever, based upon dimensions of engines or boilers, which would give a result with every variety of engine, or even with particular types of engines, at all proportional to their power, and we would respectfully submit for the consideration of the Committee,

* Read at the thirty-second session of the Institution of Engineers and Shipbuilders in Scotland on October 23rd, 1888.

† The Report issued by the Council of the North-East Coast Institution of Engineers and Shipbuilders is published in the July number of THE MARINE ENGINEER.

seeing that the registered horse power is so very misleading and worse than useless, and also that it does not come within the province of this Society to attempt to lay down a commercial standard for marine engines, whether it would not be advisable to leave it out altogether from the Register Book, and only insert the sizes of the cylinders, length of stroke, and working pressure of steam."

Notwithstanding this opinion, the Council of the North-East Coast Institution of Engineers and Shipbuilders, as already mentioned, has issued a Report on the subject of the Horse Power of Marine Engines, in which a rule is proposed for its measurement, and has invited discussion upon it. In framing the rule the Council has assumed all engines to conform to certain conditions, and the result obtained is called the Normal Indicated Horse Power (N.I.H.P.).

The following is the notation used by the Council:—

D = diameter of low pressure cylinder in inches. (If there be more than one low pressure cylinder, D^2 = sum of the squares of the diameter.)

S = stroke of piston in inches.

P = working boiler pressure in lb. per square inch above atmosphere.

H = heating surface of boilers in square feet.

P_m = mean-pressure in lb., reduced to low pressure cylinder.

R = revolutions per minute.

and the following conditions are assumed to be normal.

I. That the steam, whatever may be its boiler pressure between 50 lb. and 250 lb. per square inch, is expanded by the engines to the same terminal pressure.

II. That the expansion is effected by the engines with the same degree of efficiency for all pressures between 50 lb. and 250 lb. per square inch.

III. That the piston speeds of engines of different lengths of stroke are proportional to the cube root of their respective strokes; and, further, that the actual loaded trial trip value of piston speed may be taken as $144 \sqrt[3]{S}$.

IV. That in all cases where the engines and boilers bear to each other such proportions as to prevent Condition I. from being fulfilled, without thereby violating Condition III., the coal consumption per I.H.P. will not be effected, but will be constant for the same boiler pressure.

V. That the boilers are constructed in accordance with what will be recognised as the fair average practice of the present day in respect of the allowance of steam room in relation to power, the diameter, area, and pitch of the tubes, the relation of grate to heating surface, and the area of uptakes and funnel; that average natural chimney draught is used, or if forced draught be employed, that it does not exceed the average chimney draught; that the horse-power is proportional to the heating surface (H) and to the cube root of the pressure ($\sqrt[3]{P}$); and further, that the actual loaded trial trip horse-power may be taken as $\frac{H \sqrt[3]{P}}{16}$.

VI. That the efficiency of the engine mechanism is constant, and that the propeller is such as to secure that the engines will utilise the boiler power referred to in Condition V. in the manner presented in Conditions III. and IV.

From these conditions the rule is deduced in the following manner:—

$$\text{I.H.P. of engines} = \frac{\cdot 7854 \, D^2 \times P_m \times 2 \, SR}{33{,}000};$$

or, by substitution and reduction,

$$= \frac{D^2 \sqrt[3]{PS}}{52} \qquad (A)$$

$$\text{I.H.P. of boilers} = \frac{H \sqrt[3]{P}}{16}. \qquad (B)$$

Assuming that the power of the engines and boilers when taken together will be equal to the mean of their separate powers we have:—

N.I.H.P. of combined engines and boilers—

$$= \frac{\frac{D^2 \sqrt[3]{PS}}{52} + \frac{H \sqrt[3]{P}}{16}}{2}$$

$$= \frac{(D^2 \sqrt[3]{S} + 3{\cdot}35 \, H) \sqrt[3]{P}}{104}$$

$$= \frac{(D^2 \sqrt[3]{S} + 3 \, H) \sqrt[3]{P}}{100} \text{ approximately.}$$

For paddle engines the co-efficients require to be modified to meet the altered condition of piston speed which usually obtains in these engines, and the formula becomes—

$$\text{N.I.H.P.} = \frac{(D^2 \sqrt[3]{S} + 5 \, H) \sqrt[3]{P}}{160}.$$

The Council of the North-East Coast Institution considers the term "nominal horse-power," as at present used, very indefinite and misleading as a measure of the power of marine machinery. If, however, instead of *indicated* power, a quantity be required which will compare more nearly with what is known as "nominal horse-power," it is suggested that the above rule may be used thus:—

$$\text{Nominal Horse Power} = \frac{\text{N.I.H.P.}}{6}$$

The question which I wish the members of this Institution to consider is, whether it is advisable to adopt such a rule as has been proposed for what is called the nominal indicated horse-power. The report of the Council of the North-East Coast Institution contains some interesting explanations and tables, which show that the rule has a considerable range of application, and gives results which are fair representations of current practice. It may be mentioned, however, that in framing the rule the practice of the Tyne has been followed more closely than that of the Clyde, which in some respects has kept the lead. This fact brings out the chief objection to the rule, or to any similar rule, by which it is impossible to do more than represent average practice in a given district. In trying to get rid of the term nominal horse-power the Council has merely changed the value, and somewhat improved the method, but the quantity obtained is still essentially a nominal power, and may in a comparatively short time become as antiquated as that which it is proposed to displace.

In every department of scientific investigation the tendency has been towards the displacement of all merely nominal or qualitative measurements, by exact quantitative measurements. In mechanical engineering, and especially in marine engineering, such quantitative measurements involve so much trouble and expense that engineers and shipowners are generally content with approximations. The brake horse-power of any engine is the best test of the efficiency of the work of the engineer, but scarcely any experiments have been made to ascertain this, and none, so far as I know, with the most recent types of marine engines. Till some satisfactory method of measuring brake horse-power has been devised, in my opinion, instead of endeavouring to frame rules it would be quite sufficient to take the power as ascertained by the use of the indicator as the measure by which engines are to be bought and sold, as the efficiency of the mechanism is not likely to vary to any great extent in engines of approximately the same size. By such rules as are used, or have been proposed, it is rather the size of the engines which is measured than their power, and no encouragement is given to the engineer to exert his skill in improving their design and construction. If, on the other hand, the indicated power were taken after a lengthened trial at full power as the registered power, we would have an approximately correct quantitative measurement, and at the same time we would test the efficiency and sufficiency both of the engines and boilers. We would also avoid the stereotyping of any class of engine, and allow the engineers to be credited with skill in their work.

It may be objected that the trouble and expense connected with this proposal are so great that there is no chance of it being adopted. These might, however, be reduced to a minimum by a little management. The ordinary trial trips, as at present conducted, would, of course, be conducted for the purpose of giving a first approximation to the power, and for making the observations which are usually made on such occasions. But a longer trial could easily be arranged without involving very much expense, by taking advantage of the first run or two of the ship in the course of its ordinary business, either for the whole route or for such a part of it as might be considered necessary, the observations being made by representatives of Lloyd's, or other committee, of the makers of the engines, and the chief engineer of the vessel on behalf of the owners.

As far back as 1872 the subject of the horse power of marine engines was considered by a Committee of the Council of the Institution of Naval Architects, and the conclusions arrived at were very similar to the proposals I have made. "The committee were unanimously of opinion that the term nominal horse power, as at present ordinarily used for commercial purposes, conveys no definite meaning. The majority of the Committee were of opinion that no formulæ depending upon the dimensions of any parts of

the engines, boilers, and furnaces could be relied upon as giving a satisfactory measure of the power of an engine, and that even if the varieties of engines and boilers now in use could be comprised under one general expression for the power, the progress of invention would soon vitiate any such expression of formula."

The Committee further stated that "the entire abandonment of an old commercial standard, such as nominal horse-power, however inaccurate, must be a matter of considerable inconvenience, and accordingly, great attention was given by the Committee to the question whether that standard could not be amended and retained. Among the many plans considered, not one received unanimous or even general approval. That which met with least objection was that the indicated horse-power, as ascertained on a trial trip, should be taken either as the nominal horse power, or as a basis for it, being divided by a suitable fraction."

I will not enter into the various suggestions which have been made for improving the formulæ for the horse-power of marine engines, but I trust that some of these will be brought forward by their authors in the discussion, so that their advantages or disadvantages may be mentioned, as the object of this paper is chiefly for the purpose of drawing out the opinions of the members on the subject with which it deals. Such discussions, however, should not be purely academical, but as far as possible, their results should be translated into action. It is, therefore, highly desirable that a definite conclusion should be arrived at, and that that conclusion should be enforced with all the authority of the Institution.

FORMULÆ USED FOR NOMINAL HORSE POWER.

No.	Formulæ.	Engines of 41 & 70 cylinder, 42 in. stroke.	Engines of 33 & 62 cylinder, 39 in. stroke.	Engines of 33 & 62 cylinder, 45 in. stroke.	Remarks.
		A	B	C	
1	$\frac{D^2+d^2}{33}$ ..... =	199	149	149	
2	$\frac{D^2+d^2}{32}$ ..... =	205	154	154	
3	$\frac{D^2+d^2}{30}$ ..... =	219	164	164	Rule of makers of Engine B.
4	$\frac{D^2+d^2}{28}$ ..... =	235	176	176	
5	$\frac{D^2+d^2}{27}$ ..... =	243	182	182	
6	$\frac{D^2+d^2}{26}$ ..... =	253	190	190	
7	$\frac{(D^2+d^2) \times \sqrt[3]{S}, \text{ inches}}{100}$ ... =	229	167	175	
8	$\frac{(D^2+d^2) \times \sqrt{S}, \text{ inches}}{90}$ ... =	254	185	195	
9	$\frac{(D^2+d^2) \times \sqrt[3]{S}, \text{ feet}}{40}$ ..... =	250	180	191	
10	$\frac{D_s^2 \times \sqrt[3]{S}, \text{ feet}}{33}$ ..... =	222	172	181	
11	340 cub. in. of cylinder..... =	258	180	207	
12	800 to 700 cub. in. of cylinder =	271 to 310	189 to 216	218 to 249	
13	$\frac{\text{Area of H.P. cylinder}}{5}$ ..... =	262	171	171	
14	$\frac{(D^2+d^2) \times S, \text{ feet}}{90}$ ..... =	256	178	204	
15	$\frac{(D_s^2+d_s^2)}{2000} \times (S+30)$ ..... =	236	170	185	Rule of makers of Engine C.
16	$\frac{(D^2+d^2)}{2016} \times (S+50)$ ..... =	235	168	183	
17	$\frac{(D^2+d^2) \times \text{speed of piston}}{6000}$ ... =	462	288	328	Rule given in proposed Merchant Shipping Act, 1871.
18	Actual registered H.P..... =	256	160	200	

WE are informed that Baines' asbestos-packed cocks, which we illustrated and described in our issue of November 1st as being introduced by Bell's Asbestos Company, are alleged to be infringements of Messrs. Dewrance & Co.'s patent rights, and that Messrs. Dewrance & Co. have brought an action against Bell's Asbestos Company to restrain them from continuing the infringement.

THE "NEW GAS."

WE recently made an inspection of a sixty-light gas-plant which the "New Gas" inventors are using in their demonstrations at 6, Lombard Court, Lombard Street, E.C.

The gas is generated by passing a stream of air through gasoline contained in a special and very simple form of generator. The construction of this generator is such that the whole of the gasoline, and not only the lighter and more volatile constituents, as is usually the case, are utilized for the production of the gas.

The generator is fitted with a very ingenious service for supplying the gas at any desired pressure, and, as it (the gas) is produced at a lower temperature than the surrounding atmosphere, it expands on reaching the pipes, and consequently there is always a full volume at the burner.

The plant shown consists of a small gas engine to drive an air-pump. This pump may also be driven by hand to get up the necessary pressure of air (equalling four or five inches of water) to start with. Immediately this pressure is produced gas is generated and the gas engine is started, the pump being then thrown into gear with the engine.

On the occasion of our visit, starting all cold and with the pipes absolutely empty of gas, five seconds hand-pumping sufficed to produce sufficient gas to start the gas engine, and in seventeen seconds from starting the whole sixty-light plant was in full swing. This fact should be borne in mind by all connected with lighthouses and signal stations where the rapid production of a powerful light is occasionally of the utmost importance.

Taking gasoline at its present price, the "New Gas," when produced by its own gas engine, costs only about 1s. 9d. per thousand cubic feet, while the power required to run a sixty-light plant is only one-sixteenth of a horse power, or about the equivalent of one burner. We should here state that the "New Gas" is not a mere hydro-carbon-impregnated atmosphere, but that it is a perfect combination of oxygen and an hydro-carbon, hence it may be produced and stored for any length of time without deterioration or loss of weight, and when burned it emits neither smoke or smell. It was chemically proved, on the occasion of our visit, to be a perfectly dry gas, free from all traces of sulphur and ammonia, and no signs of the presence of any oily or greasy substance could be detected.

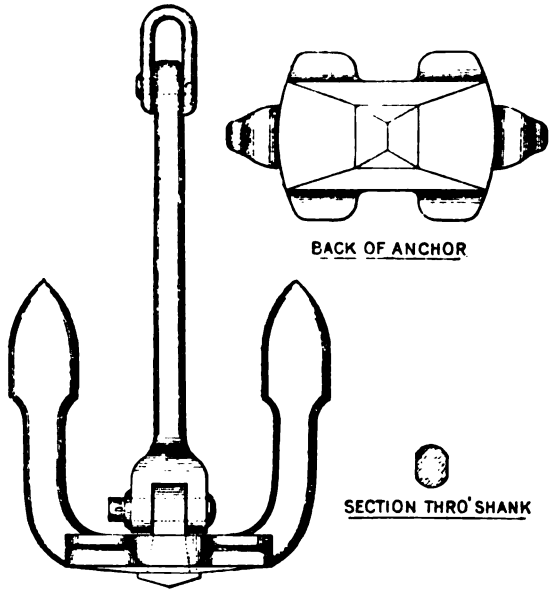
Owing to its richness and purity the value of the "New gas" for motive power purposes is nearly three times as great as that of ordinary coal gas.

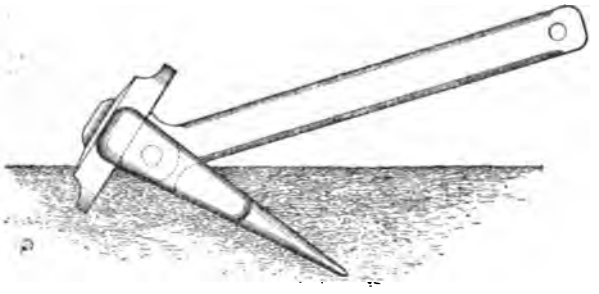
The simplicity of the whole plant, the ease and cheapness with which the gas is produced, and the rapidly available source of power thus placed at one's disposal, whether for light, heat, or motive power, should favourably commend the apparatus to the notice of all.

MESSRS. W. T. GOOLDEN & Co.—We have received a notification from this well-known firm of electric light engineers and contractors, intimating that they have removed their offices from 2, Victoria Mansions, Westminster, and their works from Westminster and Halifax, the only address in future for all departments being Woodfield Road, Harrow Road, London, W. The telegraphic address ("Dorothea," London) remains as before, and for the guidance of those of our readers who may have business relations with the firm we may mention that Woodfield Road is within three minutes' walk of Westbourne Park Station.

BYERS' & STOREY'S PATENT "RELIANCE" STOCKLESS ANCHOR.

THE accompanying illustrations, which are self-explanatory, represent a new type of stockless anchor (the joint invention of Messrs. W. L. Byers and T. B. Storey) which is now being placed on the market by Messrs. Lumsdon & Co., Limited, Strand Ironworks, Sunderland. Briefly we may state that there are two flukes to hold by, instead of only one, as is the case with stocked anchors,





and that great additional resisting surface is got in the front of the cross-head (see back and side views,—small figures) as well as in the flukes.

These anchors are made from the best forged iron, all parts being considerably over the strength required by Lloyd's tests, and, as will be readily seen from the illustrations, present a large amount of holding and resisting surface, which, combined with the large vertical area in the tripping head, renders it especially advantageous when down in soft or thin muddy bottoms. Further, the great breadth of cross-head and fluke prevent the anchor from rolling over, while its construction allows of its stowing close up to the vessel's bows in a small hawsepipe.

The "Reliance" anchor is always ready to let go, is void of all liability to foul cable, and bites quickly and holds well. As an instance of this latter qualification we may state that, on the occasion of the trial trip of the s.s. *Cyrene* at Sunderland, a trial of her "Reliance" anchors was made as follows:—The anchor was let go with forty-five fathoms of cable in eleven fathoms of water; the vessel then went full speed ahead against the anchor, which gripped almost immediately, and held well against the strain, the results of this severe test being considered most satisfactory by all on board.

The "Reliance" anchor has been approved by Lloyd's committee, and as in the designing of it Mr. Byers has had the advantage of valuable suggestions from eminent shipbuilders, both on the Clyde and the East-Coast, we may safely take it that it is an anchor which may be recommended as one which will comply with the requirements of all shipowners. Further particulars will be gladly given by Mr. W. L. Byers, of 51, West Sunniside, Sunderland, or by the makers.

THE LIFE-SAVING APPLIANCES COMMITTEE.—The first meeting of the Committee appointed under the provisions of the Merchant Shipping (Life-Saving Appliances) Act, 1888, took place at the Board of Trade on the 15th inst. The members were received by Sir Michael Hicks-Beach, Bart., M.P.; Mr. H. G. Calcraft, C.B.; Mr. Thomas Gray, C.B.; and other leading officials of the Department. The Committee subsequently elected Mr. Thomas H. Ismay as chairman, and Mr. J. G. S. Anderson as vice-chairman. In addition to those gentlemen the following were present:—Mr. D. Kennedy, Mr. N. Dunlop, Mr. W. John, Captains G. Armstrong, John Lees, and H. J. Ward, Mr. M. Callaghan, Mr. T. S. Lemon, Mr. S. I. Da Costa, Mr. C. E. Tatham, and the secretary, Mr. Walter J. Howell.

MESSRS. CLARKE, CHAPMAN, PARSONS AND CO.'S EXHIBITS AT THE LATE GLASGOW INTERNATIONAL EXHIBITION.

MESSRS. CLARKE, CHAPMAN, PARSONS & CO., of Victoria Works, Gateshead-on-Tyne, at their large stand in the machinery section of this Exhibition—now, however, a thing of the past—displayed a variety of their well-known specialities in the way of steam winches, windlasses, pumps, and steering-gears, while in one other of their items of manufacture, they certainly exhibited what was one of the most striking and novel features of the machinery section. This was one of their patent turbo-electric generators, a type of electric lighting machine now being largely introduced into merchant and war ships in this country and abroad. The generator shown by the exhibitors was employed lighting up their stand, and the brilliancy and steadiness of the lamps, taken together with the singularly compact character of the machine, and its smoothness of motion and noiselessness, kept a constant gathering of spectators around their stand in the evenings. The turbo-electric machine being the most conspicuous, as it was the most novel, of Messrs. Clarke, Chapman, Parsons & Co.'s exhibits, may be first and most fully noticed. The generator, as seen from the specimen exhibited, consisted of a steam motor and dynamo combined on one bed-plate, the whole forming an extremely compact and light machine, and specially adapted for ship-lighting, not only on account of the small space it occupies, but also for its steady running and self-regulating and self-lubricating arrangements, thus requiring very little attendance. The motor consists of a compound steam turbine, working at a high rate of expansion with great economy in the consumption of fuel. This motor is coupled direct to the armature of the dynamo, and both motor and dynamo run in bearings of special construction, and are lubricated automatically and continuously by a special mode of circulating the oil, which streams through and through the bearings, keeping them cool, with the result that although the machines run at about 9,000 revolutions per minute, the wear and tear is reduced to a minimum, and the oil being kept in constant circulation and no waste, an exceedingly small quantity is used. Another special feature about this machine is the electrical control governor, which is fitted to the magnets, by the effective action of which the lights are kept perfectly steady. This self-regulating governor is influenced by the quantity of current required to supply the lamps, which are switched on to the different circuits, and admits just the quantity of steam necessary to drive the machine, so as to give the quantity of electric current required for the lamps in use. That is to say, if 150 lights are being run, should 50 of them be switched off, a proportionate quantity of steam is shut off by the action of the self-regulating governor, which also prevents the machine being overrun, or the wires or lamps damaged through excess of current. These generators can be run for any length of time without requiring any attention, excepting for the trimming of the brushes about every eight hours. Messrs. Clarke, Chapman, Parsons and Co. have now fitted this system to various English, Italian, Chilian, Spanish, Austrian, and American men-of-war, and even to some ships belonging to the Governments of China and Japan; while in addition, over 50 passenger and trading steam-ships have been provided with this system of lighting.

Other noteworthy items exhibited by the firm were four of their Clarke-Dowson patent duplex steam pumps. The large increase of steam pressures which has accompanied the development of the triple compound engine, has caused special attention to be directed to the question of the auxiliary steam pumps required to work at these high pressures. There has been a long-standing objection held by marine engineers to direct-acting pumps, whose steam distribution is controlled by means of tappets or steam-moved auxiliary valves, and this has been recognised in the pumps under notice by entirely dispensing with tappets or valves of any kind for distributing the steam in the steam cylinders. Each steam piston is arranged to serve as an ordinary slide valve for its neighbour, and consequently this pump has, probably, the fewest moving parts of any in the market. In addition to this, positive certainty of action is obtained, one valve being always open, ready to start the piston of the other cylinder.

The Clarke-Chapman patent horizontal steam windlass, which is now so extensively employed on board ship, was represented on the stand by an example embodying all the firm's latest improvements. An inspection of this exhibit showed that it possesses a special arrangement of frictional lifting purchases. The cone being lined with wood, in an improved manner, more than double the usual holding power is obtained, and this excess of frictional power enables the cones to be made at such an abrupt angle that immediately the nut is screwed back the cable holder is at once perfectly free to revolve. A frictional spring brake is fitted to each cable holder. When the cable is being veered out, all jerks and sudden strains are taken by the spring, thus saving the windlass and cable from all breakages, and also—as no strain in checking the cable is taken by the cones—all wear and tear is saved in these parts. In this windlass, also, the very objectionable plan of pawling the cable holder is avoided when riding at anchor. The whole strain on the cables is taken by the spring under the bed-plate at the tail of the brake, thus relieving the windlass and cables from all excessive strains and jars. The engine is fitted with slide-valves of special form, so arranged that the steam pressure always keeps them close to the working face, and completely prevents leakage, and also act as reversing valves, controlled by the hand lever, thus dispensing with the usual complication of reversing valves, connecting pipes, &c.

The firm also showed their patent steam warping capstan. This capstan is driven from an engine of the horizontal type through the medium of a worm and worm wheel, thus rendering it not only noiseless in its work, but self-pawling in whatever direction it is driven. Between the cylinders is a reversing arrangement, actuating the slide-valves direct, and rendering the cocks and pipes formerly fitted unnecessary.

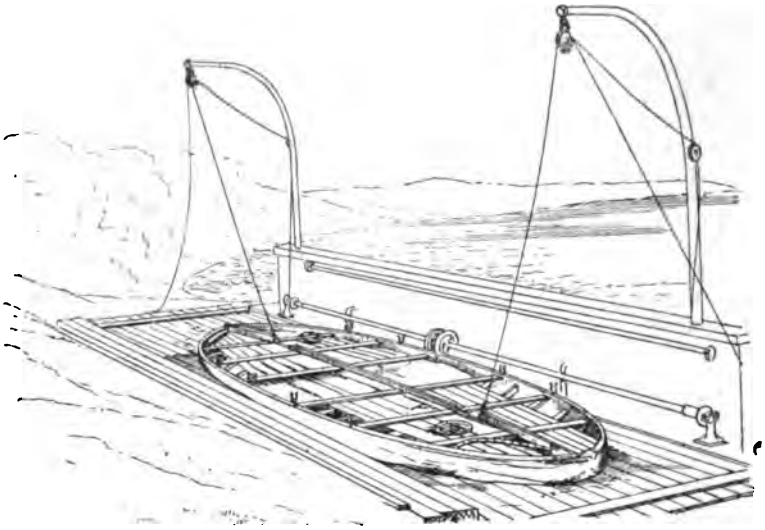
The firm's horizontal steam steering gear, and their better-known double-cylinder horizontal steam winch were also noteworthy items of this varied and admirable collection of specialities.

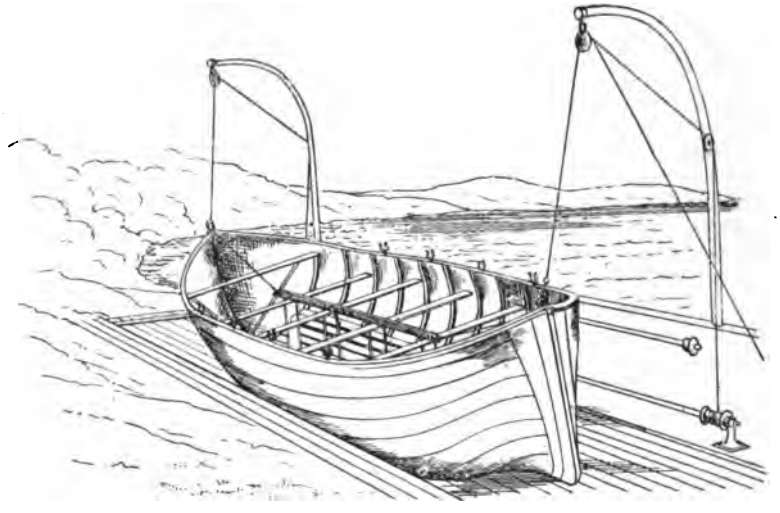
MR. JAMES J. PECK, late manager to Messrs. Napier, Shanks and Bell, of Glasgow, has been appointed manager to Messrs. R. & H. Green, shipbuilders, Blackwall, London.

HENDERSON'S PATENT COLLAPSIBLE BOAT.

THE very ingenious form of collapsible boat shown in the accompanying illustrations was a source of great interest during the late Glasgow International Exhibition, where, under the superintendence of the inventor (Mr. Charles Henderson, of 9, York Street, Glasgow), it was frequently collapsed and formed for inspection, and put into the water many times, having passengers on board on each occasion numbering from twenty to sixty-two. The dimensions of the boat are 28 ft. 6 in. by 8 ft. 6 in. by 3 ft. 6 in., and the total weight is only 11 cwt. The framework is constructed of steel and wood combined, and the outer covering, or skin, of two plies of specially prepared extra strong water-and-rot-proof canvas. The boat will carry with safety at sea sixty to seventy people, with water, provisions, etc., on board, and shows a free-board of about 2 ft. The collapsed boat measures only 11 in. in depth, with oars, mast, sail, water, and provisions on board, which admits of five *fully equipped* boats being carried, one on top of another, without occupying more space than the ordinary lifeboat. By this means no passenger steamer or emigrant ship need put to sea without a sufficient number of efficient boats to save every soul on board in case of emergency, and that, too, without increasing the weight or top hamper of the vessel.

At a special demonstration on the bank of the river Kelvin, in presence of Thomas Gray, Esq., C.B., Secretary of the Board of Trade, the boat, without the aid of davits or skilled labour, was formed in five seconds by simply drawing the stem and stern posts apart until they gained the vertical position, when the whole framework was instantaneously and automatically locked at four different points, expanding the outer covering to its proper shape and making it perfectly rigid. The boat was then hoisted on the davits to clear the bulwark, swung outboard, and lowered into the water, the whole time occupied from the moment she was touched until afloat being about sixty seconds; forty-five persons then went on board, and, under the directions of Mr. Gray, the boat was subjected to the usual stability and other tests with highly satisfactory results.





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THE TWIN-SCREW TO

BUILT BY HERR F. SCHICHAU, ELBIN

EDO BOAT "NIBBIO."

FOR THE ROYAL ITALIAN GOVERNMENT.

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At this test the boat was perfectly watertight, and the canvas showed no signs of weakness or wear, notwithstanding the fact that she had been previously collapsed and formed for inspection over five hundred times, and launched into the river over fifty times, and had numerous passengers on board on each occasion. The inventor also makes an unsinkable form of the boat by employing a double outer skin, with space between to form air-chambers.

As a cheap, handy, compact, and efficient life-saving appliance we commend Mr. Henderson's boat to the notice of all shipowners, and we trust his invention will meet with the success which it deserves.

PRINGLE'S PATENT SINGLE ECCENTRIC VALVE GEAR.

THE accompanying illustrations show the details of a new form of single eccentric valve gear lately patented by Mr. James Pringle, of 159, West Scotland Street, Kinning Park, Glasgow, which has the merit of simplicity of action and fewness of working parts in its favour.

As will be seen from the illustrations, the eccentric is secured to the crank shaft in the usual way, and around this is fitted a slide block, as shown at A, formed with two parallel sides arranged to slide between two guides forming segments of circles, as shown at Figs. B and G.

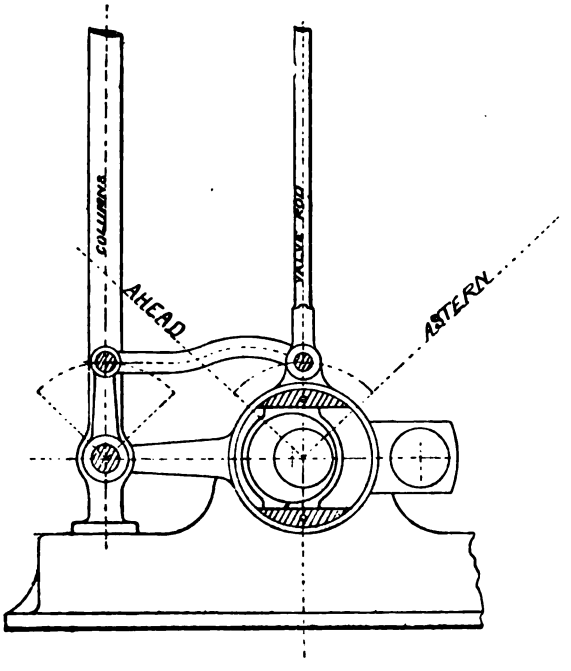
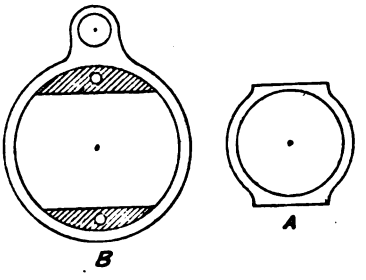
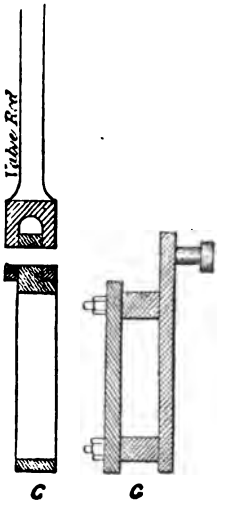


FIG. 1.

These guides are cast solid on to the frame, and turned on the outside so as to fit into a cylindrical strap, C, which is jointed to the valve rod and pivoted on the horizontal wiper, as shown in Fig. 1. A wiper keyed on to the wiper-shaft is jointed to the frame and segmental guides by the upper or curved drag rink. With this brief explanation of the working parts it is evident that, if the segmental guides be drawn by the drag rink either to the ahead or astern position, as indicated by the dotted lines of Fig. 1, that the travel of the valve, and consequently of the engines, will be altered accordingly.

It only remains to say that the slide block, A, and the cylindrical strap, C, are kept in place by the side plates, as shown in G, these plates forming a box to contain all the working parts of the eccentric proper.





The gear provides a simple and ingenious means for reversing an engine and altering its point of cut-off; and as the working parts are few, it should prove durable, and not liable to get out of order, while its construction is such as to allow of its being easily set.

THE ITALIAN TORPEDO BOAT "NIBBIO."

WE have pleasure in herewith presenting our readers with a view of a twin screw torpedo boat, built by Herr F. Schichau, of Elbing, for the Royal Italian Navy. The vessel is one of five, of the same dimensions, constructed by Herr Schichau for the Italian Government, and these, together with five other torpedo boats of somewhat smaller dimensions, make a total of ten similar vessels supplied by this well-known builder during the present summer to the same Government.

The *Nibbio*, as will be seen from the illustration, is of very graceful appearance, and differs from the general run of craft of her kind in having her two funnels so far apart. She and her four sister ships have proved themselves very good sea boats during the voyage from Elbing to Spezia, which was made in only a very few days, and without the slightest damage in any way whatever, while

at the same time, their performances on their official trials show them to be the fastest boats in existence, the average speed attained being 26·6 knots per hour in the open sea, with 14·5 tons on board at the time of trial. Each vessel is fitted with three torpedo tubes, and carries two 3·7 centimetres Hotchkiss guns. The five boats, of which the *Nibbio* is a type, are 46·5 metres long by 5·2 metres beam, and have a displacement of 130 tons. Each has two boilers and two sets of engines, together equalling 2,000 H.P., while the coal capacity of their bunkers is such as to allow a run of 4,000 knots at a speed of 10 knots per hour.

The five smaller boats supplied by Herr Schichau to the Italian Government this summer were each 37 metres long, with a beam of 4·8 metres and a displacement of about 80 tons. These vessels attained, on their official trials, a mean speed of 22·5 knots in the open sea, with 12·5 tons on board, the capacity of their bunkers at 10 knots speed being equal to a run of 3,500 knots. Each of these smaller vessels is fitted with two torpedo tubes, and carries two 3·7 centimetres Hotchkiss guns.

We have been favoured by Herr Schichau with a list giving full particulars of all the torpedo vessels built by him since 1877. These, together, reach the very high total of 160 torpedo boats and torpedo cruisers, ranging from 18 metres to 59 metres in length, the guaranteed speeds varying from 16 knots to 26·5 knots per hour, with steaming capacities, on a 10 knot speed, of from 1,000 to 6,000 knots.

We trust to shortly publish a view of this most enterprising and highly successful builder's works, and also of types of engines as built by him, when we shall have more to say on the subject of his productions.

TORPEDO BOATS FOR INDIA.

ON Tuesday, November 13th, the official trial of the last of the three torpedo boats recently built by Messrs. Thornycroft and Co. to the order of the Secretary of State for India in Council took place in the estuary of the Thames below Gravesend, and resulted in the attainment of the remarkable speed of 23¼ knots. Among those on board were Colonel Sir Owen T. Burne, member of the Indian Council; Captain Richard, French Naval Attaché; and Mr. Smale and Mr. Melrose, of the Controller's Department of the Admiralty, who conducted the trial on behalf of the India Office. The contractors were represented by Mr. Donaldson, and the machinery was in charge of Mr. Brown.

High water, with no tide to move the barges, and a crowded pool form an excellent combination for testing the manœuvring powers of any craft, and the facility with which the large torpedo boat threaded her way among the mass of barges, sailing vessels, and steamers was the subject of much remark. On arriving below Gravesend the vessel was started at full speed, and ran continuously for two hours, while at intervals during that time runs were made on the measured mile in the Lower Hope in accordance with the Admiralty practice, the results being as follows:—Mean pressure of steam, 204·6 lb. per square inch; air-pressure in stokehole, 1¼ in.; vacuum, 25½ in. Revolutions, 395 per minute, and mean speed, as already stated, 23·25 knots—a result which was considered eminently satisfactory, seeing that the vessel was carrying a load of nearly 20¼ tons, and that the contract speed was only 22 knots. A series of formal experiments were then made on the turning properties of the vessel, with both steam and hand steering gear, the result being that in going ahead the vessel turned within a radius of her own length, while in going astern the radius was even less. At the termination of the trials, the Admiralty inspectors expressed their entire satisfaction with the performance of the vessel, which, after receiving her armament, will be steamed out to Bombay.

The remarkable manœuvring qualities shown on this occasion are due to the fact that the boat, like all those built by Messrs. Thornycroft & Co., is fitted with their patent double rudders, one on each side of the propeller—a device which has the additional advantage of affording protection to the propeller against floating obstructions. The most interesting feature of the vessel, however, to the mechanical engineer was the performance of the "Thornycroft" patent tubulous boiler with which she is fitted. Briefly these boilers consist of two water chambers at the base of the boiler, and a combined water and steam reservoir at the top. This upper chamber is connected with the two lower water chambers by means of two welded steel tubes of large diameter, and by considerably over 1,000 tubes of small diameter. These latter are the steam-generating tubes, through which, on the application of heat, the water and steam contained in them are driven with great velocity into the upper part of the upper chamber; there, by means of a separator plate, the water is separated from the steam, and passes by means of the two large tubes already mentioned, back to the lower chambers, to be again driven up through the small tubes into the upper chamber. From this it will be seen that a most energetic circulation is going on all the time that the boiler is in action, which circulation, seeing that the steam is carried with the water, is equivalent to a very large area of water surface in an ordinary boiler, and prevents all priming. From the fact that the two water vessels below, and the water and steam reservoir above, are the only rigidly connected parts of the boiler, and that to these and the tube joints no heat has access—all the heat being applied directly to the steam-generating tubes, which are of small diameter and curiously contorted, so as to render them extremely elastic—it matters little what variations in temperature may be applied to the boiler, and it is claimed on behalf of these boilers that steam can be raised in them in the ordinary way within fifteen minutes from the time of lighting the fires, and that when the fires are under way it is only a matter of a few minutes to raise the pressure to any required amount, and to maintain it simply by regulating the air pressure in the stokehold. It is further claimed that, with all this, there is no symptom of leakage in the tubes or in any part of the boiler, either while the steam is being maintained at or near a constant pressure or, unlike the locomotive boiler, when the pressure has been largely lowered or the boiler put out of use entirely. Another advantage of these boilers is that, owing to their lightness as compared with the locomotive boilers, two tubulous boilers may be fitted in a torpedo boat instead of one of the locomotive type, with a considerable saving in weight. If one boiler is disabled the other would be sufficient to keep the boat going at three-quarters of the full speed.

THE RUSSIAN ARMOURED CRUISER "IMPERATOR NICHOLAS."

A VERY powerful Russian warship is ready for launching on the River Neva. She is a sister ship to the *Imperator Alexander II.*, which was launched at Cronstadt last year, and she will be named *Imperator Nicholas*. She may be described as a twin-screw composite brig-rigged armoured barbette cruiser, of much the same general character as our own *Warspite* and *Impérieuse*, but larger, and considerably heavier armed and armoured than those vessels. The value of this class of cruiser was amply proved last year, when, during the summer manœuvres, the *Impérieuse* rendered most valuable assistance to Admiral Fremantle in the Channel; and again this year, when the *Warspite* led the *Iris* and *Severn* out of Bantry Bay and subsequently distinguished herself as the most useful member of Admiral Fitzroy's Squadron of Depredation. It is well known, however, that the *Warspite* and *Impérieuse* have grave defects. The Russian vessels, which are, in fact, improved *Warspites*, will, it is expected, be free from most, if not all, of these. In one particular only are they even nominally inferior to the British cruisers. They are not intended to steam quite so fast on their trials. It is, nevertheless, extremely likely that the sea speed which will ultimately be got out of them will be quite as much as could at the present moment be got out of the *Warspite* or the *Impérieuse*, for it is doubtful whether either ship can do much more than 15 knots, save, perhaps, for an hour or two at a time. The *Imperator Nicholas* is of 8,440 tons displacement, and the I.H.P. of her engines is 8,500. The present displacement of the *Warspite* greatly exceeds that which she was originally designed to possess, and may be set down at 8,400 tons. At that displacement, however, it would be dangerous to take her into action, seeing that her armoured belt would be almost entirely under water. Her most favourable fighting displacement would probably be about 7,500 tons;

whereas the *Imperator Nicholas*, with the proper proportion of her belt submerged, will displace nearly 1,000 tons more. The difference expresses pretty accurately the real difference in size between the two ships. The Russian cruiser is 326 ft. long and 67 ft. in breadth, and will have a mean draught of 23 ft. She is armoured along the whole length of her water-line with a belt of compound armour, having a *maximum* thickness of 14 in. She is, in addition, protected by a horizontal steel deck 3 in. thick, placed immediately above the belt; and her two barbettes will carry 12 in. compound armour. Finally, her stability, even if she should be pierced in several places at the water-line, will be insured by the great number of water-tight compartments into which the ship's hull is divided. The vessel's armament will be exceedingly powerful. Each of the barbettes will carry a single 12 in. 52-ton breechloader, throwing a projectile weighing 730 lb., with a charge of 255 lb. of powder. The perforation of this weapon at its muzzle is 24 in. of wrought iron, and no heavier gun is mounted on any Russian warship. The secondary battery consists of four 9 in. 15·7-ton breechloaders, mounted behind protective shields. Each of these guns throws a 278 lb. projectile, with a charge of 64 lb. of powder, and can perforate over 13 in. of iron. The tertiary battery is composed of eight 6 in. 4·12-ton breechloaders, the projectile of each weighing 82 lb. and the charge 34 lb. The perforation at the muzzle is 7 in. In addition, the ship is to be provided with four quick-firing and six machine guns, and with four torpedo-launching tubes; and it is proposed, though not decided, to give her as well four 3½ in. breechloaders. These may, however, for the present be left out of the calculation, if it be desired to compare the *Imperator Nicholas* and her sister ship, the *Alexander II.*, with our own *Impérieuse* and *Warspite*—the only vessels of anything like similar class which we possess. We have sent the *Impérieuse* to the Pacific. The Russian cruisers are destined for the same station. It is therefore pertinent clearly to demonstrate how greatly inferior the *Impérieuse* is to a cruiser which, in the unfortunate event of the outbreak of war, say a year or two hence, would almost assuredly be her opponent. This may be done as follows:

	Impérieuse or *Warspite.*	*Alexander II.* or *Nicholas.*
Displacement in tons	8,400	8,440
Indicated horse power	10,000	8,500
Estimated sea-speed	15·7	15·6
Maximum thickness of armour	12 in.	14 in.
Number of heavy guns	10	14
Weight of heavy guns	126 tons	199·76 tons
Weight of broadside	1,060 lb.	1,614 lb.
Perforation of heaviest gun ..	19 in.	24 in.
Complement	514	570

Nor is this all. The Russian ships, as has already been noted, have complete belts at the water line. The British ships have not; and, in a moderate sea-way, the partial belts which they do possess would, at the present displacement of the vessels, be at times wholly under water. It should be borne in mind, moreover, that whereas each Russian ship carries six guns which can at close quarters pierce the thickest armour of the British cruisers, each British ship carries only four guns which can, in similar circumstances, pierce the thickest armour of the Russian vessels. This point, in these days of high explosives, may turn out to be of far greater importance than has hitherto been suspected. The *Impérieuse* and *Warspite* are undoubtedly good ships of their class; but they are far from being the most modern types of that class. This is, of course, not necessarily the fault of their designers, for in naval architecture there are few secrets that can be kept, and foreign Powers cannot be prevented from taking note of our defects or from profiting by our experience. At the same time, it is plain that the approaching launch of the *Imperator Nicholas* and the completion for sea of the *Imperator Alexander II.*, are events which should cause us to seriously consider our position in the matter of armoured cruisers, and to ask ourselves whether we, too, ought not to improve upon the *Warspite* type.

In consequence of the Neva being closed to navigation by ice, the launch has been postponed till the spring.

Erratum.—Sale of the Manx Liners *Victoria* and *Prince of Wales*.—These boats were sold for £155,000, not £140,000, as *given* in the November number.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from October 25th to November 23rd, 1888:—

Alexander, Isaac J., chief engineer to the *Hecla*, to date November 14th.
Anderson, Robert, fleet engineer to the *Agincourt*, to date November 7th.
Attwood, George, assistant engineer to the *Northumberland*, to date November 10th.
Banister, Charles, assistant engineer to the *Archer*, to date November 10th.
Barry, George W., engineer to the *Conqueror*, to date October 27th.
Bingham, Percy, assistant engineer to the *Cleopatra*, to date November 29th.
Bolt, Charles W., acting assistant engineer to the *Agincourt*, to date November 10th.
Bramsdon, William H., engineer to the *Seagull*, to date October 27th.
Bryan, William, fleet engineer to the *Volcano*, to date November 7th.
Burgess, John H. A., assistant engineer to the *Monarch*, to date November 10th.
Butcher, John B., assistant engineer to the *Hecla*, to date November 6th.
Chope, William D., engineer to the *Devastation*, to date November 13th.
Coleman, Walter, engineer to the *Skipjack*, to date November 2nd.
Cooper, Robert H., engineer to the *Himalaya*, to date November 19th.
Davis, William A. J., acting assistant engineer to the *Amphion*, to date December 4th.
Dawson, Frederick G., acting assistant engineer to the *Tamar*, to date October 31st.
Durston, Albert J., fleet engineer to the *President*, additional, to date November 23rd.
Edgar, Edward J., engineer to the *Pembroke*, additional, to date November 2nd.
Edwards, George K., assistant engineer to the *Aurora*, to date November 10th.
Ellis, Edgar H., assistant engineer to the *Cleopatra*, to date November 29th.
Ellis, Ernest F., engineer to the *President*, to date November 13th.
Featherstone, W. J., engineer to the *Victor Emanuel*, additional, to date November 19th.
Gale, William H. C., chief engineer to the *Cleopatra*, to date November 29th.
Grant, William H., engineer to the *Indus*, supernumerary.
Hellyer, Thomas A., engineer to the *Hero*, to date November 14th.
Ham, Septimus, acting assistant engineer to the *Invincible*, to date November 13th.
Hardcastle, C. V., assistant engineer to the *Cleopatra*, to date November 29th.
Harris, Herbert W., acting assistant engineer to the *Rover*, to date October 31st.
Hawkins, Hugh, engineer to the *Mariner*, to date November 20th.
Jordan, Charles F. (probationary), assistant engineer to the *Active*, to date October 31st.
Knapman, Henry T., engineer to the *Ajax*, to date November 13th.
Lewis, Benjamin J., engineer to the *Peacock*, to date November 27th.
Little, Henry J., acting assistant engineer to the *Hercules*, to date November 13th.
Meadus, Harry H., engineer to the *Linnet*, undated.
Metcalfe, Henry W., assistant engineer to the *Impérieuse*, undated.
Moore, Francis J., chief engineer to the *Pembroke*, to date November 20th.
Morris, Thomas C., acting assistant engineer to the *Amphion*, to date October 31st.
Mortimer, John E., acting assistant engineer to the *Hotspur*, to date November 13th.
Murray, John A., engineer to the *Calypso*, to date November 2nd.
Pendleton, C. F. B. (probationary), assistant engineer to the *Hecla*, to date November 6th.
Pitt, John, chief engineer to the *Archer*, to date December 11th.
Platt, Charles, fleet engineer to the *Shannon*, to date November 7th.

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INDUSTRIAL NOTES.

CLYDE AND EAST OF SCOTLAND.

THE revival in British trade, which set in towards the close of the summer, has continued to increase in volume in this part of the kingdom until, at the present moment, all our leading industries are in a healthier condition than they have been since the "break" which occurred in the fall of 1883.

Shipbuilding naturally claims first mention, and it is pleasing to note that the marked vitality by which this trade was characterised during the months of September and October has been fairly well maintained throughout November. Thus, during the three weeks ending 20th ult., something like 18,000 to 19,000 tons of new work was put into the river, the "vacant spaces" being rapidly filled up by the keels for new vessels. In October 14 vessels, aggregating quite 40,000 tons, were launched, so that altogether about 60,000 tons have been completed in Clyde yards within little more than seven weeks.

The contracts arranged for during the month have not, it must be conceded, been so bulky or numerous as those obtained either in September or October; but, when we recollect that the orders secured during those two months were exceptionally heavy—aggregating as they did nearly 100,000 tons—we cannot in all reason deign to complain on this point. Amongst the more notable of the new orders is one for four steamers, each of 360 ft. in length, and is understood to have gone to a firm on the lower end of the river, and is believed to be for Portuguese owners; an order for a paddle-steamer, 220 ft. long, placed with Messrs. Caird & Co., Greenock, by an English firm of shipowners; and an order for a 3000 ton steamer, which is stated to have been given to Messrs. Mackie & Thomson, the new Govan shipbuilding concern, by a Glasgow firm.

Included in the latest marine engineering contracts is an order, settled with Messrs. Kincaid & Co., engineers, Greenock, for the construction of two sets of powerful triple-expansion engines for a shipbuilding firm on the east coast of England.

About the middle of the month the rumour was widely current in Glasgow marine engineering districts, viz., that the Admiralty had resolved to re-engine those ships of a modern type which broke down during the recent manœuvres. Local engineers are, however, by no means sanguine that any of the work will come to their doors.

Quite a large number of important railway engineering schemes, principally relating to the west country, have been talked of in "influential circles" during the past month, and it is commonly believed that Parliament will next year have a busy time of it in listening to the arguments of the respective promoters.

Some little interest was taken amongst local engineers in the recent visit to this city (Glasgow) of His Excellency Mr. E. J. Phelps, the American Minister to St. James'. Mr. Phelps' primary object in coming hither was to deliver an address under the auspices of the Glasgow Juridical Society, but he was not many hours arrived ere he "honoured" the big shipbuilding works at Fairfield with a visit, and thereafter proceeded to the Steel Company of Scotland's works at Newton, where he manifested keen interest in our most improved process of steel making.

A really useful institution of its kind is the Glasgow and West of Scotland Engine Keepers' Association. The inaugural meeting for the present session was held in Glasgow on the 5th November, when a flourishing report was submitted, and an instructive address on "The Origin and History of the Steam Engine" delivered by Mr. Lorimer, of Messrs. Dubbs & Co.

Another very useful institution is the Glasgow Technical College, the Wenting Branch of which held its annual meeting on the 5th, when a report of a very satisfactory character was read.

As indicative of the rapidity with which shipbuilding can be accomplished on the Clyde I would refer to a 5,000-ton steamer which the Fairfield Company have just ready for launching, the keel of which was only laid about four months since.

Seven pounds a ton is the price said to have been obtained for a large quantity of shipbuilding steel plates sold in the Glasgow district about the middle of the month.

A case of peculiar interest to marine engineers is presently before the Court of Session. I refer to an action by Professor W. Thomson, of Glasgow University, against Mr. Batty, the well-known marine compass manufacturer, Liverpool, in which the plaintiff seeks to restrain defendant by injunction from infringing

a patent taken out by him for improvements in the marine compass. The case was before the Court on the 21st November and is still *sub judice*.

An evening class for the study of marine engine drawing and engine design is about to be opened in the Glasgow University. The class is intended for students who are unable to attend during the day, and will be conducted by Mr. Robert Johnston, assistant to Professor Jenkins, who holds the Chair of Naval Architecture founded at the University some years ago by Mrs. John Elder.

The Glasgow International Exhibition, the machinery department of which afforded so much interest to engineers from all parts of the world, closed its doors on the 10th November. Altogether between five and six million persons visited the Exhibition, from which there is a surplus of about £50,000.

An extensive engineering establishment is, I hear, about to be erected at Kilbowie, the seat of the Singer Machine Company Works, and situate about six miles from Glasgow.

The ancient Scotch mechanical engineer, Mr. John Turnbull, Senr., died on the 19th November. Mr. Turnbull, who was in his 82nd year, was for many years connected with the Canal Basin Foundry, Glasgow, and was closely identified with the manufacture of stationary engines of various types.

A deputation of French shipowners and merchants visited Glasgow on the 29th October and inspected the various local harbour works. The distinguished strangers also had a "look in" at the Exhibition, which was then in full swing.

The Leith Navigation School continues to flourish, as I learn that during the past year the school earned for scientific teaching a grant for £176, which is the largest in the United Kingdom. The number of seafaring entrants for mathematics, navigation, and nautical astronomy during the year was 579, and of non-seafaring students for science subjects 97.

A mechanical laboratory is about to be established in connection with Edinburgh University, the expenses of which will be met out of a fund of £3,000 bequeathed to the University by the late Mr. J. Fulton.

North of Scotland.—There is not much of interest respecting trade in the northern towns to record this month. The local industries of Aberdeen and Dundee have continued fairly active, while the shipping operations at both ports have been on the whole pretty satisfactory. Trade disputes have not been so rife as in the previous month, the only notable disagreement having been that between the Dundee mill workers and their employers. An amicable arrangement was come to, but the operatives in one mill have again struck work with the object of securing the advance conceded at once instead of on the 1st January next.

Two Dundee gentlemen, whose names have not transpired, have invented an apparatus for cleaning cotton seed, the importance of which can be imagined when I state that the inventors are (according to rumour) to receive the sum of £100,000 for the rights of their patent from a syndicate formed for the purchase of same.

An action by Messrs. Alley & Maclellan, engineers, Glasgow, against Messrs. Pearce Brothers, shipbuilders, Dundee, is presently pending in the Court of Session. Pursuers claim £91 10s. as the price of a Sentinel combined hand and steam steering-gear supplied to the defendants in August, 1887.

The steamer *Black Prince*, 100 ft. long by 18 ft. 9 in. beam, and with engines of 250 H.P., has just been purchased by Mr. William High, fish salesman, Dundee. The vessel is to be used for trawling purposes. The Dundee barque *Iona*, 378 tons register, has been sold to a Liverpool firm of shipowners.

The United Asbestos Company, Limited, of 161, Queen Victoria Street, E.C., are issuing a very neat form of advertisement in the shape of a paper-knife. The value of the knife as a paper-cutter is enhanced by having on one of its edges a scale of (English) inches, and on another of its edges a scale of (French) millimètres. In addition, the handle of the knife displays, six months on each side, the calendar for 1889, while one face of the blade is given up entirely to some ten or twelve small but distinct pictorial representations of the firm's leading specialities. In the circular wrapper of the knife the company call attention to the fact that they spare no efforts to maintain the old high standard of their goods, and in proof of their success in this effort we may state that they have been again awarded (for the fourth time) the Admiralty annual contract for the sole supply of fine-spun asbestos yarn packing and their special asbestos metallic H.P. jointing materials (for manhole, mudhole, and steam) to her Majesty's navy. This company, we are reminded, also hold contracts for the supply of several other Government departments, and have recently been favoured with the contract for the Dutch marine.

TRADE NOTES FROM THE TYNE, WEAR, HARTLEPOOLS, &c.

The Tyne.—Inquiries for steamers of large tonnage are still being addressed to Tyne builders in undiminished numbers, and prices have stiffened considerably. Material of all kinds is becoming dearer, and the value of labour is also going up; it is consequently impossible for shipbuilders who desire to conduct their business on safe principles to accept contracts at anything like the low rates that have hitherto been paid. In spite of the difficulties created by the necessity of keen bargaining on the part of both owners and builders, several new orders have been placed during the month, and enough work has thus been secured to make a continuance of the present briskness a matter of certainty for the next six months. Messrs. R. Stephenson & Co., who lately launched a vessel named the *Hindoo* for Messrs. Wilson & Sons, Hull, have obtained from the same firm an order for another vessel of exceptionally large dimensions. Both vessels will be completely fitted for passenger accommodation, and the engines and boilers will be supplied by the builders. Messrs. Hawthorn, Leslie and Co. have eight large vessels now on the stocks, most of them being in very early stages. One of the vessels is a Government contract, and some of the others are ordered by Brazilian and Russian owners. Messrs. W. Dobson & Co. will shortly launch a splendid steamer to be named the *Port Caroline*, which has been built to the order of Messrs. William Milburn & Co. Messrs. Armstrong, Mitchell & Co. are laying down three vessels of the largest class at their Low Walker yard, and the whole of the remaining berths at this establishment are occupied with oil carrying steamers. Messrs. C. S. Swan & Hunter are as usual extremely busy, and are now putting down keel blocks for a large vessel in a berth which was lately vacated. Messrs. Schlesinger, Davis & Co. have the whole of their building space utilised, and are fitting out two vessels beside the yard. Messrs. Palmer & Co. have eight vessels in progress at their Jarrow yard, and five at their establishment on the opposite side of the river, making thirteen in all. There are in addition four vessels on the river, either being engined, or waiting turns to go under the shearlegs for that purpose. The Tyne Iron Shipbuilding Company are now laying down a large vessel to replace one lately launched, and they have three others in different stages of progress. The yard, which formerly belonged to Messrs. H. S. Edwards & Sons, and which has lain idle for some time, has been taken over by a newly constituted company, who have already commenced the preliminary arrangements for the building of two large vessels, orders for which have been secured. Messrs. T. & W. Smith, who for over a couple of years have confined their operations to repair work, have booked orders for vessels, and have recommenced building at their North Shields yard. Messrs. Readhead have five vessels on the stocks, and are fitting out the s.s. *North Flint*, which was launched towards the close of last month. The vessel is now nearly ready for sea. At this period of the year the repairing establishments usually become much busier than at other seasons, and it is therefore no surprise to find that all such concerns on the Tyne are at this moment very actively engaged. In the marine engineering establishments the utmost activity is still to be noticed. In some cases work is kept back by delays in the delivery of castings. The operative boilermakers have obtained an advance of 1s. per week in the wages rate, with the promise of a further advance of 1s. later on. Messrs. Joicey & Co., engineers, etc., Forth Banks, are making a large addition to their iron foundry, this course being rendered necessary by the continually increasing orders for marine engine and other castings that are being received. The Jarrow Forge Company are also enlarging their premises, with a view to putting down more plant. The Ouseburn Forge, which lately came into the possession of Messrs. John Spencer & Sons, is now in full activity, a state of matters which was not known to exist at this well-appointed establishment for a long time previous to its coming into the hands of the present proprietors. Messrs. Donkin & Nichol, who have already supplied twenty of their well-known hand and steam steering gears to the Austrian Lloyd's at Trieste, have received orders from the same source for six others. They have also a large number of orders for the same speciality, to be supplied to first-class steamers building on the North-East Coast. Messrs. Emerson, Walker & Thompson Brothers, the noted manufacturers of steam windlasses, winches, etc., at Dunston, have several contracts of special importance in hand just now, and their factory was never busier. Messrs. Clark, Chapman, Parsons & Co., who enjoy a high reputation as makers of the same class of deck accessories, are having as much work as they can deal with in this line, and are

also quite full of work in their electric light department. Another firm whose business engagements are just now both numerous and urgent is Messrs. Carrick & Wardale, of Redheugh Engine Works. Their steam feed, bilge, and ballast pumps appear to be steadily gaining in public estimation. The various departments of Messrs. Black, Hawthorn & Co.'s works continue to be kept busily employed, and at Messrs. Abbot's establishment a similar condition of uniform prosperity is to be noted in the different shops. The anchor shops are particularly busy, some further large orders for Tyzack's patent anchor having been received. The manufacturers of wire rope are participating largely in the prosperous state of business now very generally existing, the numerous orders for steamers' rigging that are coming to hand contributing largely to this result. The Elswick Ordnance Works, which form so important a feature in the industrial aspect of Tyneside, are now busy throughout, and the steel works connected with the great concern are as actively employed as any similar works in the country. The iron works of the district continue in constant operation, a state of matters which presents a gratifying contrast to the condition of affairs a year ago, when the operatives considered themselves fortunate if they could succeed in getting employment for one or two weeks in each month. The improvement in the iron trade has brought forth a claim for an advance of wages, which, however, is not destined to cause any unpleasant complications, as the services of an arbitrator have been requisitioned to decide the matter. The question was fully gone into on a recent occasion, when both employers and employed were represented. At the time of writing the arbitrator had not given his award. Mr. Wasteneys Smith, Newcastle, has secured a number of important orders during the month for outfits of his patent stockless anchors, and, with the large number he has already in hand, business will be very brisk in this department for some time to come.

The Wear.—As the close of the year approaches, the briskness in the Wear shipyards shows, if anything, a tendency to increase. There is evidently a desire on the part of shipbuilders to hasten the execution of contracts, with a view to make the aggregate output for the year of their respective establishments as large as possible. Independently of this consideration, there is, of course, the natural wish to get on quickly with the construction of vessels when orders are plentiful, but the feeling indicated always seems to give an additional stimulus to the efforts of even the most energetic managers at this period of the year. That the Wear, as a seat of shipbuilding, is holding its own in the estimation of shipowners, is evidenced by the fact that several vessels of a high-class are now placed for construction on the river. Among these may be mentioned, one for the British India Steam Navigation Company, building by Mr. James Laing, and one for Messrs. Wilson & Sons, Hull, to be shortly laid down in the yard of Messrs. R. Thompson and Sons. Both these vessels are of immense size, and will be elaborately fitted out for the conveyance of passengers, and in each case it may be confidently prophesied that when the vessels are completed, their owners will have reason to be satisfied with their choice of builders. The firm last referred to have lately added to their plant a large frame bevelling machine which has been found to be a most important auxiliary in frame bending operations, and they are now placing in position a hydraulic machine of great power, by which keel-plates may be bent to the necessary angle without being heated. Messrs. J. L. Thompson and Sons launched, on November 17th, a splendid passenger vessel of the largest class, which has been built to the order of a Spanish firm. As details respecting this vessel will be given elsewhere, it is unnecessary to make further reference to it in this column, excepting to say that it is the largest yet turned out by the enterprising builders, and has only been exceeded in size by one other vessel yet built in the port. The firm have six large vessels now in progress, and a number of orders in reserve, and the quantities of material that are daily being delivered in their yard are perhaps larger than the daily deliveries at any other shipbuilding establishment on the north-east coast. Messrs. Short Brothers launched, on November 15th, a specially well-built cargo boat, to be added to the fleet of Mr. John Tully. The vacated berth was immediately filled with another keel, and by the time these notes are in print, the large vessel for which the latter is intended will doubtless be framed out. The output from Messrs. Short Brothers' yard this year will probably consist of ten vessels, representing an aggregate tonnage of considerably over 20,000 tons. Messrs. W. Doxford & Sons launched another vessel this month, and it may be remarked in passing that excepting in the early spring period, they have not missed a month this year without putting a vessel off the stocks. Besides the vessels launched, however, they have got through a great quantity of work in the way of alterations, etc., since the beginning of the year, and the extent of their operations during the twelve months will by no means be correctly represented in the returns of vessels launched, which may be expected to be published at the end of December. The Sunderland Shipbuilding Company launched a fine vessel for a local owner during the month, and they have now all berths occupied. At the time of writing Messrs. Austin have two steamers undergoing repairs in their graving dock, and they have more orders for new vessels than they can complete within the next six months. The old steamer *Hector*, which formerly belonged to Mr. Gourley, M.P., but which had been sunk by collision at the mouth of the Tyne several months ago, and lain submerged until recently, has been put into the bridge dock for a thorough overhaul. A large portion of the shell plating will have to be renewed, and taking into account the repairs to be done to the interior fittings also, it is estimated that the vessel must remain in the dock for at least two months. Messrs. J. Blumer & Co. of the North Dock shipbuilding yard, have a great quantity of work to proceed with, and are now about to utilise a building berth which has been lying idle for several years. Since 1884 they have not had at any time more than two vessels on the stocks, but the demands for early delivery from customers now make it necessary that they should utilise the whole of the building space at their disposal, and they will accordingly have four vessels in simultaneous progress very shortly. In the engineering trade the state of exceptional briskness noted in previous reports is maintained. Mr. John Dickinson is now engaged in placing in position the largest triple-expansion engines yet manufactured at his establishment, and he has received orders for three other sets of triple-expansions of an equally powerful type. An unusually large number of Dickinson's patent crank shafts have been turned out lately, and there appears to be no doubt that this speciality is coming more into favour as its merits become better known. The North Eastern Engineering Company continue to book orders in cases where customers are not too exacting in the matter of delivery. As the company have now enough work in hand, however, to last them for twelve months or more, it is clear that those who are now placing orders must be content to wait a long while before they see them put in execution. At Messrs. Doxford's and Messrs. Clark's works business is as brisk as ever. Mr. A. A. Rickaby has received from an eminent shipbuilding and engineering firm in the North a large order for pumps and engines of a special type, and his factory in Bloomfield Street, Monkwearmouth, is already beginning to show evidences of the exceptional briskness likely to result from this accession of work. At the Pier Engine Works repairs to steamer engines continue to keep up a fair state of activity, and a good many orders are being received for the brassfounding department that has lately been added. The manufacture of Messrs. Smith & Stephen's patent chain wheel, for which there is a steadily increasing demand, has been transferred from these works to another establishment where orders can be executed with greater promptitude and despatch. Messrs. Welford Brothers are so pressed with orders for steering gears and steam-winches that an extension of their fitting shops will probably become necessary. Mr. John Wigham, of Hylton, has also a large number of orders for such deck accessories as those just referred to, and his ship repairing department is kept pretty busy. Messrs. John Lynn & Co. have just supplied a powerful and finely finished hand and steam steering-gear to the s.s. *Smileworth*, built by Messrs. Short Brothers. Trade exigencies have compelled the proprietor of the Portobello Foundry to add a new wing to the establishment, and by means of this extension it is expected that the production will be largely augmented. There is a scarcity of skilled workmen in this branch of business, however, and until this difficulty is overcome the full results anticipated can scarcely be attained. Messrs. J. L. Thompson & Sons are now carrying out a further important extension of their Pallion forge, and a powerful new steam hammer by Messrs. Davis & Primrose, of Leith, is to be put down. On a future occasion further details respecting this new enterprise will be given. The whole of the other forges continue to show the very fullest activity, and in this industry, as well as in the iron-founding business, there is a scarcity of skilled hands. The chainmaking department at Messrs. Lumsden & Co.'s works is very actively employed, but the anchor shops are not correspondingly brisk. It is understood, however, that the firm have a good many orders for Messrs. Byers & Storey's newly introduced patent anchor, and this department is consequently bound to become brisk very shortly. The bolt and rivet works in the district are having as many orders as can be dealt with, and it is understood that a new factory for the manufacture of these

articles will be started in the course of a few weeks. Nothing has yet been done at the Castletown Ironworks with a view to preparing for the contemplated commencement of the steel manufacture. There is little doubt, however, that a start will be made very shortly with the preparatory arrangements, and it may be safely concluded that they will then be pushed on with vigour.

The Hartlepools.—Messrs. W. Gray & Co. launched two vessels during November, and the output of tonnage from their establishments this year promises to "beat the record." The rapidity with which work is turned out by this eminent builder is indeed almost phenomenal, and this circumstance goes far to show that in shipbuilding, at all events, quickness of execution is by no means inconsistent with stability and perfect finish. The whole of the available building space in the new yard as well as in the older establishments is now occupied, and in the frame-bending departments operations are carried on night and day. One of the vessels now in progress, or shortly to be laid down, is a large passenger boat for Messrs. Wilson & Sons, Hull, and it is expected that in future a larger proportion of orders for high class vessels will be attracted to the port than has hitherto been the case. At Messrs. Withey & Co.'s establishment the pressure of work is exceptionally heavy, and at Messrs. Irvine & Co.'s yard there is an abundance of orders. The Central Marine Engine Works are still kept exceedingly busy, and it may be stated that some of the engines in progress are of unusually large power. Considerable progress has been made with the erection of the new forge, and before many weeks are past it will be in active operation. The steel works that were recently started are now showing extraordinary briskness, and if the productive power were twice as great, it would not exceed the needs of the moment. Cement manufacturers at this centre are now being offered more orders than they can accept, and rope-makers are as busy as they have been at any former period. The season of activity in the timber trade being near its close, imports from the Baltic are now more than ordinarily numerous, and it is found necessary to employ extra labour in the work of discharging. The saw mills are very fully supplied with orders, the requirements of shipbuilders and house-builders being just now rather pressing. Coal shipments are becoming heavier, now that winter has set in in earnest.

The Tees.—Messrs. Raylton, Dixon & Co. is one of the firms that have been entrusted with the building of one of the half-dozen first-class passenger steamers which Messrs. Wilson & Sons, of Hull, are about to add to their fleet, and all of which are placed for building in the North. The firm have an abundance of other work, and the greatest possible activity is evidenced throughout the various departments of their establishment. Considerable briskness is now appearing in several departments of the Tees-side Engine and Iron Company's Works, and the large iron foundry at Port Clarence is quite full of work. The wages dispute which existed a month ago in the engineering department of Messrs. Bolckow, Vaughan & Co.'s works has been settled, but only a limited number of the hands were re-engaged. The briskness in the Stockton shipbuilding yards fully equals the activity existing in the same class of establishments at other centres in the North, and there is little doubt that when the record of this year's work in this industry is presented to the public the output from the district now under notice will bear favourable comparison with the production elsewhere. Marine engineering establishments are, if possible, a shade busier than when last noticed, the principal establishment at this centre being called upon to supply engines, etc., for vessels building at almost all the shipbuilding ports of the North. Messrs. Ashmore, Benson, Pease, & Co.'s works, and also Messrs. Head, Wrightson & Co.'s large establishment are very satisfactorily employed, and are likely to continue so during the winter. The pneumatic system of riveting, the plant for which is supplied by Messrs. De Bergue & Co., of Manchester, was adopted some time ago at both the above-mentioned works, and has been found to be a very powerful aid to rapid and economical production. The Stockton forge is still extremely busy, and the same may be said respecting Messrs. Rogers & Co.'s steam-winch and steering-gear works, and Messrs. Riley Brothers' boiler works. In the local iron and steel works a high state of activity is maintained, and most of the less important industries of the district have benefited by the improvement in the staple trades.

Darlington.—The great resources of the Darlington Forge Company are now being pretty fully utilised, the orders for ship and engine forgings of the heaviest class being more than usually numerous. Orders for steel castings are also plentiful, and this important department of the company's works is quite busy. Wagon works at this centre are fairly active, and most of the other local industries are tolerably prosperous.

THE MERSEY.

SHIPBUILDING continues dull on the Mersey, and until there is a further spurt no new orders will be expected here. We have apparently to wait until the other shipbuilding rivers are satisfied before we begin on the Mersey to book further business.

Messrs. Laird still form the exception to the general rule—they apparently are always to the fore. They have launched during the past month a small twin-screw steamer, which they have built to the order of the Government of the Argentine Republic, and which was christened *Jenner* by Miss Allan in the presence of Colonel Blanco (who represented the Argentine Republic) and a few other friends. The *Jenner* is of about 220 tons deadweight and is to be fitted with triple-expansion engines of about 400 I.H.P., which are now being constructed in Messrs. Laird's well-appointed fitting shop. This steamer has been specially designed for the service of the Board of Health at Buenos Ayres, and has every requisite for quarantine purposes.

Whilst referring to Messrs. Laird we may mention, as some indication of the increase of the business of this firm, that they are now engaged in the erection of a new boiler works of very large dimensions, that will, on completion, enable them to double the work that they have hitherto turned out.

During the recent visit of the channel fleet to the Mersey the admirals commanding and a large number of the officers of the different branches of the service were entertained at Messrs. Laird's shipbuilding yard, and were afterwards shown over the entire works by the members of the firm. At the present time the yard is a scene of great industry, there being eight vessels, ranging in size from a tugboat to a magnificent passenger and mail steamer of between 7,000 and 8,000 tons burthen, in course of construction. The engine department is also equally busy, as they have now in course of erection engines of 4,500 I.H.P., and boilers for H.M. torpedo gunboats *Ekipjack* and *Speedwell*; and also engines of 12,500 H.P. for the large mail steamer we have already referred to, and which we may say is being built to the order of the Hamburg American Steam Packet Company. This vessel will steam at the rate of 19 knots per hour, and her fittings will in every respect be of the most elaborate description. She is being built under the covered shed and will shortly be floated and named the *Columbia*. Messrs. Laird have also been fortunate enough to obtain the order for a sister ship from the same company, and are busy now arranging for the laying down of the keel. The Great Western Railway Company have three fine channel steamers now building in the same yard. These are all twin-screw boats and will be entirely built of steel. The London and North-Western Railway Company are also building a twin-screw tugboat, which is expected to be ready for delivery very shortly. The Campa Sud Americana de Vapires of Valparaiso have a steamer now approaching completion in No. 3 Slip. This vessel will be 333 ft. long and will have engines of 3,000 I.H.P. The other yards remain passively inactive, but with a fresh spurt in the trade no doubt they will get their share. The steam launch trade is rapidly becoming a speciality at our port, as both Messrs. Waddington and Messrs. Cochran continue to be fully employed, and we hear that both firms have further business in view.

Freights, both outward and homeward and in all directions, have sustained a decided check, all of which are easily accounted for. The bad weather now ruling in the Mediterranean Sea, but especially in the Black Sea, has been the means of frightening merchants from chartering ahead, consequently steamers going in that direction, and whose owners are anxious to secure something definite, have, in view of the limited market, been forced to accept lower figures than have been current for a few months past. This relapse, however, is only temporary, and with better weather—that is better weather than has been the normal condition of things lately—owners will wait, and more money, per consequence, will have to be paid as the vessels become more prompt.

Indian freights have not moved much lately, but the tendency generally has been downward. This, of course, is a movement of a sympathetic nature, and is entirely occasioned by the temporary weakness in the Black Sea market and the peculiar condition of the cotton market in America. This latter is suffering from a ring among the bagging merchants, who have, besides forcing the cost of bagging to an abnormal price, also succeeded in limiting the production of same, so that although cotton is plentiful enough, baggers for bale purposes continue scarce, hence the weakness apparent in the cotton freights now ruling.

But everything comes to those who wait, and a patient attitude of firmness on the part of the merchants and shipowners will soon restore things to their former condition, and then up go freights and the sky of the freight market will again be serene.

WELSH NOTES.

THE shipbuilding trade, which has been comparatively neglected in Wales, is at length coming to the front, and it is possible that within a short time Welsh shipowners will be under no necessity whatever to go to the East Coast or Clyde to purchase their steamers. The Hull Shipbuilding, Dry Dock and Engineering Company, Limited, of Cardiff, after years of idleness in their shipyard, have one steamer of some 3,000 tons on order. Then Mr. T. A. Walker, the eminent contractor, has established an extensive yard at Sudbrooke, a new town which he founded in connection with his Severn Tunnel Works. At this yard there are at present four steamers of 500 tons carrying capacity in course of construction, and he proposes building eleven more steamers of a similar size. These are intended for shallow water service in connection with the new harbour works at Buenos Ayres. At Newport it is reported that a North Country shipbuilding firm are in close treaty for 46 acres of land on which to erect a branch yard at a cost of some £50,000; and to finish the list, Laird & Co. are said to be treating for the purchase of the Landore-Siemens Steel Works at Swansea, in connection with which they propose to establish a shipbuilding yard. The two reports concerning Newport and Swansea are, so far, mere rumours, but there is every possibility of the Newport negotiations, at any rate, coming to a successful termination. So far as Swansea is concerned, we fear there is no suitable site for the erection of a large shipbuilding establishment.

As our readers will have gathered from the above paragraph, the Landore-Siemens Steel Works remain idle, and they will continue so until a purchaser be found for them, for the old Landore-Siemens Steel Company, of whom so much was expected at the outset of its career, has gone over to the majority of unsuccessful companies. That this concern should have proved unsuccessful surprises no one acquainted with the manner in which it has been carried on. The place appears to have been little more than an experimentalising shop for the benefit of other Siemens' Steel Works. This sort of thing is, no doubt, of great advantage from a scientific point of view, but extremely unsatisfactory to shareholders.

There is some talk at Cardiff of the Bute people constructing a new railway to the Rhondda Valley coal fields, and connecting at Hirwain with the line of the Rhondda and Swansea Bay Railway Company, a very inestimable advantage to the latter line. It will be remembered by some of our readers that the Marquis of Bute purchased the Glamorganshire Canal some time since, and it is this canal which will be utilised in the construction of the new Bute line. Whether the surveying, and so on, which is now in progress is meant to serve any other purpose than to frighten the shareholders in the Taff Vale Railway Company into consenting to an amalgamation of the Bute Docks and Taff Vale Railway Companies remains to be seen. When an attempt was made by Mr. J. Inskip, the chairman of the Taff Vale Company, and some of his co-directors to bring about an amalgamation a year ago, serious opposition was raised by the shareholders, with the result that the proposal was dropped. Fear of opposition may, however, do more with shareholders than Mr. Inskip's persuasive eloquence is capable of doing, and hence the present activity on the part of the Bute authorities may cause shareholders in the railway to give way when next the amalgamation scheme be broached.

The Barry Company, it is reported, will very shortly open a section of their line from Penarth Dock to Cadoxton, which is about two miles from Barry Dock, and a place of an importance due simply to the new dock works. In the future Cadoxton will be to Barry docks what Cardiff is to Bute docks. The main Barry line, however, and the docks, will not be opened until next May.

The construction of the Rhondda and Swansea Bay Railway is being pushed ahead as fast as possible, and its opening should not be long after that of the Barry line. It is reported that the Swansea Company are about making an attempt to secure the necessary powers for a new line of their own from Port Talbot, whence, under present arrangements, their traffic is to be taken to Swansea by the Great Western Railway. Should any such attempt be made, it will lead to considerable and powerful opposition; and some people are of opinion that, considering the existing agreement between the two companies, the new one had better "bide a wee" before attempting to secure the necessary powers for extension of their line. If, notwithstanding opposition, the necessary powers be obtained, there should be no difficulty in securing the capital to carry out the extension, for the line already manages to earn sufficient not only to pay the preference charges, but a small dividend on ordinary stock as well. It is, of course, by no means a new thing for a railway in course of construction to pay dividend, but it usually comes out of capital. In paying dividends out of earnings the uncompleted Swansea line occupies a position as unique as it is commendable.

The tin plate trade of the district appears to be in a flourishing condition. Prices remain firm, and as all works are full of orders which will keep them going over the year's end, there is not likely to be any drop for a considerable time. By March or April of next year we shall, however, in all probability, find a great change, for many new mills are being erected. The total number is about 100, or one-fourth as many as are now working. The effect of the increase of stuff put on the market by these new mills could but have the effect of reducing prices. True, the supply does not at present equal the demand, but the difference by no means calls for an increase of 25 per cent. in the output.

Ever and anon we hear rumours of Swansea being made a port for the steamers engaged in the Atlantic trade, but up to the present the talk has ended in talk, and talk only. Now, however, there is a report of a bill being introduced next session for power to construct a deep water pier at the Mumbles, and to continue in connection with it the present Swansea and Mumbles railway, a light railway in which is run the present steam tram service between the two places. The scheme is by no means new, for about a year ago there was much talk made about it. The delay has been caused, we understand, by a clause in one of the Swansea Harbour Trustees Acts, empowering that body to levy a charge of 5s. per ton on all goods shipped or landed to the west of their docks. This would embrace the whole of Swansea Bay, and consequently the very site on which it is proposed to construct the new pier. It is reported now, however, that the trustees will not insist upon this charge, and the scheme thus becomes very feasible. The new Rhondda and Swansea Bay line will take the best Welsh coal to Swansea cheaper than is now done to Cardiff. This, coupled with the facts that the pier will run into deep water, approachable at any time of tide, and that vessels coaling at the Mumbles could proceed direct to the Atlantic, will no doubt have the result of securing a success for the promoters of the new scheme. In our next issue we shall have more to say about this.

Messrs. Mordey, Corney & Co., Limited, the chief ship repairers in Newport, are about constructing a new dry dock 350 ft. long, and will, at the same time, increase the size of their yard. Their works already cover five acres, and the company can do anything in their own line, from painting a ship's bottom to turning out a steamer with engines, boilers, and hull, built on their own premises. They have already built a number of small steamers.

Reverting to what we said above about the Taff Vale and Bute Dock Companies, it has just been reported that a working agreement has been decided upon. The directors of the Railway Company "have unanimously sanctioned the publication," says the secretary of the company, "by the Bute Docks Company, of a Parliamentary notice, authorising this company, with the approval of the shareholders, to enter into an agreement for the working of the Bute docks." This course, if finally decided upon, will mean the taking over by the railway company of the docks undertaking on terms which have not yet been disclosed.

The general trade of the district keeps good, coal prices are firm, and most people expect we shall have yet higher quotations. In the coal trade there is some doubt as to how prices will go on account of an uncertainty as to the action of the men on the wages question. There are nine colliery owners who are open to make contracts with the condition that for every rise of 5 per cent. in the men's wages the coal price shall be raised 6d. These men possess something more than Yankee astuteness, seeing that a five per cent. rise in labour means only about 3d. a ton; but then Cardiff coal shippers are celebrated for their smartness in many ways. The impression all round is that we shall have higher prices in 1889, but there can be little doubt that the improvement in shipping will only prove temporary. Shipowners and shipshareholders have been pursuing a most suicidal policy of overbuilding again, and there can be little doubt that the result will be experienced in the Welsh freight market ere many months are over.

BELFAST TRADE NOTES.

THE shipbuilding industry here is in a very prosperous state, and with every promise of plenty of work for many months to come. Messrs. Harland & Wolff, Queen's Island, are, as usual, very fully employed, their very extensive engine works, to which they recently made some additions, working night and day, yet withal they have had to place orders for engines with other firms. The s.s. *Palmas* which left here recently received her engines and boilers at the hands of Messrs. McIlwaine, Maccoll & Co., Limited, shipbuilders and engineers, Belfast, and now the splendid screw steamer, *Lord Londonderry*, built to the order of the Irish Shipowners' Company, Belfast, will receive her machinery from Messrs. Howden & Co., Glasgow. Their ten slips are fully occupied, two of them by two twin-screw steamers building to the order of the White Star Line, and whose Transatlantic passages are looked forward to with considerable interest, as likely to be equal to, if not surpass, some of the greyhounds of the Atlantic. They are both noble-looking vessels, and one of them, the *Majestic*, will likely be launched early in the New Year. The engines, of the triple-expansion type, are rapidly approaching completion, and will be splendid specimens of our modern marine engine. Being twin-screw, there is, of course, two sets of engines. In order to obviate any vibration, &c., the machinery is extra strong, and there is every reason to believe that these ships will prove all they are expected to be. As for the hulls, they will be practically unsinkable. There is also very near ready for launching a sister ship to the White Star Liner s.s. *Cufic*, launched last month. The *Cufic* is now rapidly approaching completion, and in a few weeks will be ready for sea. Messrs. McIlwaine, Maccoll & Co., Limited (formerly McIlwaine, Lewis & Co. Limited) have made a change in the firm's name, through Mr. Maccoll, formerly manager of Messrs. J. Jack & Co., Victoria Engine Works, Sandon Dock, Liverpool, having entered the firm, are at present very busy, both in the engine works and shipyard, and will launch early in the New Year a screw steamer named the *Topic*, to the order of Mr. Grainger, Belfast. Their other slips are full, one in particular being a large steamer. They also find it necessary to have a night shift in their engine works. They have the s.s. *Alps* in hand for thorough repair, new boilers, and compounding her engines. They have just re-fitted the s.s. *William Hinde*, of Belfast, with a new boiler.

Messrs. Workman, Clark & Co., Belfast shipyard, have all their slips fully employed. The s.s. *Lady Martin*, built by them to the order of the British and Irish Steam Packet Company, Limited, Dublin, has been towed to Glasgow to receive her engines and boilers, which will be supplied by Messrs. Dunsmuir & Jackson, Govan. They this month launched a new steam ferryboat to the order of the Belfast Harbour Commissioners, the machinery for which will be supplied by Messrs. D. & W. Grant, York Street Foundry, Belfast.

STEAM HOPPER DREDGER FOR JAPAN.—Advices just received by cable announce the safe arrival at Yokohama, Japan, of a steam hopper dredger, supplied to the order of Messrs. John Birch & Co., of Liverpool, by Messrs. W. Simons & Co., of Renfrew. This craft left the Clyde on the 26th of August last, the time occupied on the voyage being exactly 100 days, including all delays at intermediate ports, coaling, etc., and it may be considered as a very good performance, taking into consideration the type of craft. This dredger is the first English-built dredger introduced into Japan, and she is to be used at present in deepening the shallows opposite Tokio. Her dimensions are:—Length, 120 ft., by 28 ft. beam, and 12 ft. 3 in. deep; and she has a hopper capacity of 6,000 cubic feet, or equal to fully 300 tons of dredgings. She is fitted with a pair of compound surface-condensing engines of 250 I.H.P., and a steel multitubular horizontal type of boiler, 10 ft. 2 in. diameter and 8 ft. 9 in. long. The deck arrangements, which are most complete, include two steam crab winches for mooring or regulating the cut of the dredger, one placed at the stern, the other at the bow. The craft is a single ladder, central well hopper dredger, and the bucket ladder is of ample length, to allow the buckets to dredge to a depth of 30 ft. when the ladder is at an angle of 45 deg., and so arranged that the craft cuts her own flotation. The buckets are of sufficient capacity to lift 300 tons of free soil per hour from the depth given. The vessel was thoroughly tried on the Clyde before leaving, both for speed and dredging capacity, by the purchasers, and gave every satisfaction.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—ENGLISH.

Gulf of Guayaquil.—On October 24th Messrs. Hawthorn, Leslie & Co., Limited, launched from their yard at Hebburn-on-Tyne, a cargo steamer to the order of the Greenock Steamship Co., Limited. This vessel is the third of four arranged for towards the end of last year with the same builders, and is a sister ship to the *Gulf of Corcovado*, launched some time ago, the dimensions of both being 310 ft. by 40 ft. by 24 ft. The engines, boilers, etc., are being constructed by Messrs. Blair & Co., Limited, Stockton-on-Tees, the engines being of the triple-expansion type, with cylinders of 26 in. by 42 in. by 69 in., and 48 in. stroke, which are expected to drive the steamer at a speed of over 11 knots per hour at sea. There will be accommodation for about 30 first-class and a number of second-class passengers, and electric lighting fitted throughout. On leaving the ways the steamer was named *Gulf of Guayaquil* by Miss M'Gregor, niece of the Rev. Dr. M'Gregor, of Edinburgh. She is intended for the West Coast service of the company, and will be despatched in December under command of Captain Edward Friend, now of the *Gulf of St. Vincent*.

Baltic.—On October 27th Messrs. Earle's Shipbuilding and Engineering Company launched the new steam fishing-vessel *Baltic*, which they have built for the Grimsby Steam Fishing Co., Limited. This boat is a duplicate of the *Arctic*, recently completed for the same owners, and is intended for line as well as trawl fishing, her dimensions being 100 ft. by 20 ft. by 11 ft. 6 in. She is built to Lloyd's highest class, with considerable excess of scantlings in various respects, and has provision in the holds, in addition to the fish-well, for the storage of fish, ice, etc. She will be fitted with a set of triple-compound three-crank engines, and a powerful steel boiler, made for a working pressure of 150 lb. per square inch, also made by Earle's Company.

Oldham.—On November 1st Messrs. Earle's Shipbuilding and Engineering Company, Limited, launched from their yard at Hull the s.s. *Oldham*, which they have built to the order of the Manchester, Sheffield, and Lincolnshire Railway Company for their Continental trade, and which is designed for the conveyance of general cargo and passengers. The dimensions are 240 ft. by 30 ft. by 16 ft., and the vessel is built of iron to Lloyd's highest class. Water ballast is provided in double-bottom on cellular system all fore-and-aft, to assist in bringing the vessel to a suitable steaming draught, and she is arranged with poop, bridge, and topgallant forecastle. Accommodation is provided in the poop for about 40 first-class passengers, with dining-saloon in polished hard woods, and all necessary conveniences, while the officers and engineers are berthed under the bridge and the crew in the forecastle; the fore 'tween decks is also fitted with portable berths for emigrants. The ship will be schooner rigged, and have efficient appliances for working cargo in the shape of three powerful steam winches and two steam-cranes. Higginson's steam steering gear is fitted on the bridge, and a powerful screw gear aft. The vessel has fine lines, and is expected to attain a good speed. Her machinery consists of a set of triple-compound engines, having cylinders 22 in., 35 in., and 57 in. diameter, by 42 in. stroke, and two steel boilers, made in accordance with Lloyd's and Board of Trade rules, for a working pressure of 150 lb. per square inch.

Norwood.—On November 2nd Messrs. W. Gray & Co. launched a fine steel screw steamer of the following dimensions:—300 ft. length over all, 38 ft. beam, and 22 ft. 2 in. depth; built to the order of Messrs. Maclean, Doughty & Co., of West Hartlepool, and classed 100 A1 at Lloyd's. The vessel is of the well-decked type, with poop aft, containing saloon and cabins for officers and a few passengers, long raised quarterdeck, long bridge of extra strength right up to fore hatch, and containing comfortable quarters for the crew; the usual topgallant forecastle is fitted forward with Emerson, Walker & Co.'s patent windlass. The hull is built on the web-frame principle, dispensing with hold beams, and giving a clear hold for working cargo; five hatches are fitted, four steam winches, steam steering gear, and two donkey boilers. Double bottom under each hold for water ballast. The boats are carried on beams overhead, and the vessel will in every respect be thoroughly equipped for general trading. The engines, which are on the triple-expansion principle, are being supplied by Messrs. Blair & Co., Stockton-on-Tees. The vessel has been superintended during construction by Mr. Abbey on behalf of

the occasion. She was gracefully christened *Norwood* by Miss Clara Maclean, daughter of the owner.

Lord Shaftesbury.—On November 3rd there was launched from the yard of the Whitehaven Shipbuilding Company an iron four-masted ship, named the *Lord Shaftesbury*, of 2,330 tons register.

Kasbek.—On November 3rd there was launched from the Low Walker yard of Sir W. G. Armstrong, Mitchell & Co., a steel, spar-deck tank steamer, specially constructed from the designs and specifications of Mr. Henry T. Swan for the carriage of petroleum in bulk, and inspected while building by Messrs. Flannery, Baggallay & Johnson, of London and Liverpool on behalf of the owners, Messrs. Lane & MacAndrew, of London. The vessel will be rigged as a three-masted schooner, and is 310 ft. long b.p., and extreme breadth 40 ft. 3 in., with a moulded depth of 29 ft. 6 in., and is constructed to carry 4,000 tons on a light draught of water. The oil is carried in seven tanks. The vessel will be fitted with triple-expansion engines, with cylinders 23 in., 37 in., and 60 in., and 39 in., stroke, also by Sir W. G. Armstrong, Mitchell & Co., and calculated to drive the ship over 9½ knots when loaded.

Hindoo.—On November 3rd there was launched from the shipbuilding yard of Messrs. Robert Stephenson & Co. (Limited), Hebburn-on-Tyne, a passenger and cargo steamer built for Messrs. Thomas Wilson, Sons & Co., of Hull. The dimensions are:—Length, 380 ft.; beam, 43 ft.; depth, 30 ft. 4 in.; and she will have a deadweight capacity of some 5,500 tons. The hull and machinery will take the highest class at Lloyd's. She has been built to the three-deck rule, with a long bridge amidships, with saloon house above having accommodation for passengers and officers; the ends of the vessel are protected by long turtle-backs, forward and aft. There is a cellular double bottom throughout the length of the vessel, the whole of the hull being built of steel, and the rudder and sternpost are of cast steel. There are a number of special features in the vessel, all the latest improvements in the hull and machinery of ships of this type having been embodied in her construction. There is a powerful steering engine by Messrs. Amos & Smith placed in a wheel-house accessible from the engine-room, and the gear is worked from the flying bridge amidships by means of rods led along the deck. In the after wheel-house Hastie's screw steering apparatus is fixed to the rudder-head, and there is a powerful wheel brake for controlling the rudder when necessary, and patent buffers are fitted for lessening the shocks on the steering chains. An efficient system of steam fire-extinguishing is applied to all compartments of the vessel, and the cabins are heated by steam throughout. The arrangements for the rapid loading and discharging of cargo are very complete. There are six cargo hatchways, two of them being of large dimensions, double derricks are fitted to each hatch, and there are five 8 in. by 12 in. steam-winches of special design, supplied with steam from a multitubular winch boiler, which is placed in a house on the bridge deck. The propelling machinery consists of a set of triple-expansion engines of about 2,000 I.H.P., the steam being generated in two large double-ended boilers, fitted with Henderson's patent self-cleaning furnaces. Both engines and boilers have been constructed by Messrs. Robert Stephenson and Co. (Limited), at their engine works, Newcastle. The vessel was named the *Hindoo* by Miss Hassell, of Tynemouth.

Terra.—On November 5th Messrs. Ropner & Son launched from their shipbuilding yard at Stockton-on-Tees a steel screw steamer of the following dimensions:—Length, 324 ft.; breadth, 40 ft. 6 in.; depth, 21 ft. 6 in. She will be classed 100 A1 at Lloyd's, and is of the modern well-deck type, having break poop, raised quarter-deck, bridge extended to foremast, short well, and t.g.f. Cellular bottom for water ballast, with all the latest improvements, and will have a carrying capacity of 4,350 tons. Her engines and boilers are by Messrs. Blair & Co. (Limited), having cylinders 23½ in., 39 in., and 64 in., with 42 in. stroke. The christening ceremony was performed by Miss Herskind, daughter of one of the managing owners, who gave her the name of *Terra*. The steamer has been built to the order of Messrs. Herskind & Woods, West Hartlepool.

Drumfell.—On November 5th there was launched by Messrs. Robert Thompson & Sons, from their Southwick yard, Sunderland, a steel three-decked steamer for Messrs. Gillison & Chadwick, of Liverpool. Dimensions:—Length between perpendiculars, 305 ft.; breadth, 39 ft. 8 in.; depth, 25 ft. 7 in. Class 100 A1 at Lloyd's under special survey, cellular double bottom for water ballast, steel decks covered with yellow pine, large hatchways, four horizontal steam winches and two donkey boilers, direct-acting steam windlass and steam steering gear. Accommodation is provided for the captain and passengers in full poop aft; officers and engineers are berthed amidships, and the crew and firemen in large topgallant forecastle. The engines are by the North-Eastern Marine Engineering Company, Limited; are tri-compound 23½ in., 38 in., and 62 in., with 42 in. stroke, with two double-ended boilers 160 lb. pressure. The vessel will carry 4,000 tons on a draught of 23 ft. 3 in., with a net register tonnage of 1,608 tons. On leaving the ways she was named the *Drumfell* by the wife of Captain Chubb, the inspector.

Echuca.—On November 5th Messrs. Raylton, Dixon & Co. launched from the Cleveland Dockyard, Middlesbro', a handsomely modelled steel steamer, which has been built to the order of William Lund, Esq., of London, for his well-known line of steamers between the Thames and Australia. The vessel, which is constructed on the three-deck rule, is 340 ft. in length, with a breadth of 40 ft. and a depth of 28 ft. 8 in., and is of much finer lines than the ordinary cargo steamer, being designed with a view to speed quite as much as deadweight capacity. Her poop aft will be handsomely fitted for passengers, while captain and officers are accommodated in the bridge amidships. She is fitted throughout in a very superior manner as a first-class vessel, and her engines, which are being constructed by Messrs. Thomas Richardson & Sons, Hartlepool, are on their well-known triple-expansion design, with cylinders 27½ in., 43 in., and 71 in. by 48 in. stroke, developing about 2,000 I.H.P. On leaving the ways, the vessel was gracefully christened *Echuca* by Mrs. Lund, the wife of the owner. The *Echuca* has been built under the superintendence of Captain McKenzie, the superintendent of the Company, and the engines under the supervision of Mr. A. Thomson, of London, the superintending engineer. Cleveland Dockyard presents at the present time an exceedingly busy appearance, as, in addition to the vessel launched, there are on the stocks in various stages of progress five other steamers, varying from 4,500 to 3,600 tons each, and employment is now being given to over 2,000 hands. Messrs. Raylton, Dixon & Co. have also now, in addition, their No. 2 Dockyard; and although it is only a few weeks since they took possession of this, one large vessel is nearly all framed, another one in active progress, and a third commencing.

Mary Anning.—On November 5th, Messrs. Richardson, Duck and Co., launched from their building-yard at South Stockton an iron screw steamer of the following dimensions, viz.:—Length over all, 286 ft., breadth, extreme, 37 ft. 5 in., depth of hold, 20 ft., tonnage, gross, about 2,100 tons. The vessel, which has been built to the order of Messrs. Anning Bros. of Cardiff, has a raised quarterdeck, long bridge, and topgallant forecastle, and is classed 100 A1 at Lloyd's. She has a double bottom on the cellular principle in after and main holds, and under engines and boilers, capable of holding 422 tons of water ballast, and is fitted out with four steam winches, steam steering gear, patent stockless anchors, and all modern improvements for facilitating the loading, discharging, and manœuvring of vessel. The engines, by Messrs. Blair & Co., Limited, of Stockton, with cylinders 21in., 35 in., and 57 in., by 39 in. stroke, are expected to give her a speed of nine knots. The vessel was named the *Mary Anning*, the christening ceremony being gracefully performed by Miss Mary Anning, sister of the owners.

Bishopsgate.—On November 5th Messrs. Joseph L. Thompson and Sons successfully launched from their North Sands Shipbuilding yard a steel steamer of about 3,500 tons deadweight capacity, built to the order of the Bishopsgate Steamship Co., Limited, of London, Mr. H. W. Dillon being managing director. This vessel is of the raised quarter-deck type, and on the improved system of web-frame construction adopted by Messrs. Thompson, having six steel bulkheads dividing the vessel into seven water-tight compartments. The engines are of 200 H.P. of the triple-expansion type, and have been built by Mr. John Dickinson, of Palmer's-hill Engine Works. Two steel boilers, each of 150 lb. pressure, will be fitted. The deck machinery consists of direct steam windlass, steam winches, and steam steering gear, supplied with steam from donkey boiler, which is placed on deck. The vessel on leaving the stocks was named the *Bishopsgate* by Miss Agnes Dillon, eldest daughter of Mr. H. W. Dillon. The ship and engines have been during construction under the supervision of M. John Walton on behalf of the owners.

Jenner.—On November 8th Messrs. Laird Brothers launched from their works a small twin-screw steamer, which they have built to the order of the Government of the Argentine Republic,

and which was named *Jenner* by Miss Allan in the presence of Colonel Blanco, representing the Argentine Government, and a few friends. The *Jenner* is of about 220 tons o.m., and will be fitted with triple-expansion engines of about 400 I.H.P., which are being made by Messrs. Laird. She has been designed for the service of the Board of Health at Buenos Ayres and will be specially fitted for quarantine purposes.

Arbib Brothers.—On November 14th a steel screw steamer named the *Arbib Brothers*, built for Messrs. E. and E. Arbib London, was launched from the shipbuilding yard of Messrs. C. S. Swan & Hunter, Wallsend. The vessel is of the following dimensions:—Length, 330 ft.; breadth, 40 ft.; depth moulded, 27 ft.; classed 100 A1 at Lloyd's under special survey, on the three-deck rule with poop, long bridge-house, topgallant forecastle, water ballast in cellular double bottom, five steam-winches for the rapid discharge of the cargo, large multitubular donkey boiler, steam steering gear, direct steam windlass, and other appliances of the most modern description. The engines are on the triple-expansion principle, built by Messrs. Richardson & Son, Hartlepool, and are capable of indicating 1,500 H.P. The vessel has been designed for economical carrying of cargoes to the East by the Cape route. The ceremony of naming was performed by Mrs. Enrico Arbib, of London. The steamer has been built under the superintendence of Mr. James Casey, London.

Snilesworth.—On November 15th Messrs. Short Brothers launched from their yard at Pallion, Sunderland, a steel screw steamer, built to the order of Mr. John Tully, of Sunderland. Her dimensions were:—Length, 281 ft.; breadth, 40 ft.; and moulded depth, 22 ft. 3 in. She has been built under special survey, and to the highest class for steel in Lloyd's registry, and constructed with full poop aft, bridge-house amidships, and topgallant forecastle. The after cabins, for the accommodation of captain and officers, are very commodious. The accommodation for engineers is across after end of bridge-house, the crew having accommodation in topgallant forecastle. The vessel is fitted with water ballast all fore-and-aft on the cellular principle, divided for trimming purposes. She has been specially constructed for the ore trade, having ore trunk in each hold. The hatchways are very large. There is a powerful steam-winch at each for rapid discharge of cargoes. On leaving the ways the vessel was named *Snilesworth*, by Miss Maggie Tully, daughter of the owner. The vessel was taken to the works of Mr. John Dickinson, where she will be fitted with triple-expansion three-crank engines of 180 N.H.P., with two steel boilers having a working pressure of 150 lb.

Screw Steamer.—Last month Messrs. John Jones & Sons, at the Brunswick Dock, Liverpool, launched a steamer, which has been built for the order of Mr. A. Embericos, Braila, from plans and specifications by Messrs. W. Esplen & Sons, and will be fitted by Messrs. John Jones & Sons, with triple-expansion engines, manufactured by them at their St. George's Ironworks. The steamer was docked in the Sandon Dock to receive her machinery, and will be ready for sea by the end of the month. She is intended for the Danube trade, and will carry 2,800 tons, and is expected to steam ten knots on a consumption of thirteen tons.

Rutherglen.—On November 17th this ship was launched from Messrs. Palmer's Jarrow yard. She is 312 ft. long, 40 ft. beam, and 27 ft. 6 in. deep, and will be propelled by engines having cylinders 23½ in., 38 in., and 62 in., by 42 in. stroke, the boiler power being larger in proportion than usual. She is fitted with direct steam windlass, combined steam and hand steering gear, powerful winches, double donkey boilers, and other modern appliances for quick handling and dispatch; will carry 4,200 tons deadweight; and has been superintended during construction by Messrs. Flannery & Blakiston, of Liverpool and London. She was christened by Miss McCulloch, daughter of one of the directors of the Caledonia Steamship Company, Liverpool, the owners of the vessel. The secretary of the company, Mr. Charles Crichton, was also present at the launch. It is some years since Messrs. Palmer launched two ships from their Jarrow yard on the same tide, the s.s. *Argus* being launched simultaneously; and the manner in which both ships were safely launched and moored in a high wind was most creditable to the builders.

Serica.—On November 17th there was launched from the yard of the Sunderland Shipbuilding Company, Limited, a steel spar-decked screw steamer, built to the order of Frederick Gordon, Esq., of Sunderland. The vessel is constructed with cellular double bottom, having water ballast all fore and aft, and her dimensions are: Length, 322 ft.; breadth, 40 ft.; depth, 28 ft. 3 in.; deadweight capacity, 4,200 tons; classed 100 A 1 to Lloyd's special survey. The vessel is fitted with four steam winches and large donkey boiler, patent windlass, steam steering gear, and the most modern appliances for the rapid loading and discharging of cargo. The main engines are manufactured by Messrs. Black, Hawthorn & Co., of Gateshead, upon the tri-compound principle, having cylinders 23½ in., 39 in., and 64 in., by 42 in. stroke, with two large boilers working at 160 lb. pressure. Upon leaving the ways the vessel was named *Serica*; immediately after which she was towed to the Tyne, to have her machinery put on board.

Argus.—On November 17th, at Palmer's Shipbuilding Company's yard, a two-masted schooner, 325 ft. in length, 40 ft. in breadth, and 24 ft. depth of hold, was launched. The vessel is built to class 100 A1 at Lloyd's, and is of the three-decked type, with an iron deck laid. She is fitted with full poop, containing accommodation for captain and 12 passengers, and a long closed bridge amidships providing accommodation for the engineers and officers, while the crew and firemen are berthed in the topgallant forecastle. The upper and main decks are fitted all fore-and-aft for carrying cattle. She is also fitted with water ballast in double-bottom in after hold and under boilers, some of the trunks being arranged for carrying fresh water for the use of the cattle. The vessel is also fitted with five watertight bulkheads, Clarke Chapman's patent windlass, and Harrison's steam steering gear amidships, and Hastie's screw gear aft. She will load 3,800 tons deadweight. She was built to the order of Mr. A. Currie, Melbourne, and as she left the ways was named the *Argus*.

Kong Frode.—On November 17th this vessel was successfully launched from the yard of Messrs. W. Doxford & Sons, at Pallion. She has been built to the order of Det Sondenfjelds-Norske Dampekibsselskab, at Cristiania, for the general trades, is entirely of steel and built to Lloyd's 100 A 1 class. She has also been built under special survey of the Norwegian Veritas, and has obtained the highest class, 1 A 1, under the superintendence of Mr. Bodin, and she has been inspected by Mr. Stenersen on behalf of the owners. The principal dimensions are:—Length between perpendiculars, 215 ft.; breadth, moulded, 30 ft.; depth, 16 ft. 6 in. The engines are triple-expansion, three cranks, with all Messrs. Doxford's latest improvements, the cylinders being 16½ in., 27½ in., and 44 in. diameter respectively, and the stroke 30 in., and they are supplied with high-pressure steam from exceptionally large boilers. She is fitted with Messrs. Bow McLachlan's patent steam steering gear, and Hastie's screw gear aft, and has 3 ft. 6 in. by 10 ft. and 1 ft. 7 in. by 12 ft. horizontal steam winches, by Messrs. Welford Bros., of Pallion, with all the most recent improvements for cargo purposes. The cabins are most tastefully constructed in mahogany amidships, and give comfortable quarters for the captain; the officers and engineers being berthed aft, and crew in forecastle.

Conde Wifredo.—On November 17th there was launched from the shipbuilding yard of Messrs. J. L. Thompson & Sons, North Sands, Sunderland, the steamship *Conde Wifredo*. The vessel was named by Miss Florence Dickinson, and the steamer was then towed to Messrs. Dickinson's quay, where she will receive her engines. The dimensions of the *Conde Wifredo* are as follows:—Length, 390 ft. over all; breadth, 44 ft.; and depth moulded, 32 ft. 2 in. She is built on the structural cellular and solid floor principle, to class 100 A1 at Lloyd's, and is also additionally strengthened above Lloyd's requirements. The vessel will have three complete decks, two of which are steel covered with yellow pine, and six steel bulkheads, and will have Board of Trade certificate for passengers and Suez Canal service. Accommodation will be provided aft for first-class passengers, and amidships for the officers, engineers, and 70 second-class passengers, the 'tween decks being arranged for about 500 emigrants and steerage passengers. The engines will be of exceptionally large power, of the triple-expansion type, and have been built by Mr. John Dickinson, of Palmer's Hill Engine Works. The cylinders are 31 in., 51 in., and 83 in. respectively, having a stroke of 54 in. The boilers are six in number, and are of the multi-tubular form, built of steel, for a pressure of 160 lb. to the square inch. The engines will, it is anticipated, indicate about 3,000 H.P. The vessel and engines have been under the supervision of Mr. James Cochrane, the superintendent appointed on behalf of the owners, and Captain Gorordo will take command of the vessel on completion. The deck machinery will consist of horizontal steam winches, direct steam windlass, and steam steering gear, being supplied by a large and efficient donkey boiler, which is placed in the stokehold.

Depina G. Midalina.—On November 19th Messrs. R. Irvine and Sons, of West Hartlepool, launched from their shipbuilding

yard a steel steamer of the following dimensions, viz.:—Length, 261 ft.; breadth, 36 ft.; and depth, 17 ft. 11 in. She has a long bridge, half-poop quarter-deck, and topgallant forecastle; cellular double bottom for water ballast; three large hatches for working cargo, and steam winches for each hatch, and patent steam steering gear. Her engines will be triple-expansion, by Blair and Co., Stockton-on-Tees. She is to the order of a Greek firm, and was named *Depina G. Midalina* by Miss Lohden, daughter of Mr. Lohden, of West Hartlepool.

Wandsworth.—On November 19th Messrs. W. Gray & Co. launched a fine steel screw steamer of the following dimensions, viz., Length, over all 270 ft.; breadth, 36 ft. 6 in.; depth, 19 ft. 5 in.; built to the order of Messrs. Watts, Ward & Co., London, and classed 100 A1 at Lloyd's. The vessel is of the well-decked type with poop aft, containing saloon and cabins for officers and a few passengers, long raised quarter deck, long bridge of extra strength, right up to fore hatch, and containing comfortable quarters for crew; the usual topgallant forecastle is fitted forward with Emmerson, Walker & Co.'s direct steam capstan windlass. The hull is built on the web-frame principle, dispensing with hold beams, and giving a clear hold for working cargo. Five hatches are fitted, four steam winches, steam steering gear, and two donkey boilers. A cellular double bottom is fitted throughout for water ballast, and the vessel will in every respect be well equipped for general trading. The engines, which are on the three-cylinder triple-expansion principle, are being supplied by Messrs. Blair & Co. (Limited), Stockton-on-Tees. The vessel and machinery are being superintended by Capt. T. Hodgson and Mr. Alchin respectively, on behalf of the owners. The ship was gracefully christened *Wandsworth* by Miss Lucie Pyman, of West House, West Hartlepool.

North Gwalia.—On November 20th, at the shipbuilding yard of Messrs. John Readhead & Sons, West Dock, South Shields, a steel screw steamer was launched of the following dimensions, viz.:—Length, 290 ft.; breadth, 39 ft.; depth of hold 20 ft. The vessel has been built to the order of Messrs. Hugh Roberts and Son, of Newcastle, and will be classed 100 A1 at Lloyd's. She is of the improved well-deck type, and constructed to comply with the Grain Cargoes Act. The engines, also built by Messrs. Readhead & Sons, are on the triple-expansion principle, having cylinders of 22 in., 36 in., and 60 in., with a stroke of 39 in. Steam will be supplied from two large steam boilers, working at a pressure of 160 lb. to the square inch. The steamer was named the *North Gwalia*, and is a duplicate of the *North Flint*, launched from the same yard on the 22nd October, and also belonging to Messrs. Hugh Roberts & Son.

Hessle.—On November 21st there was launched from the shipbuilding yard of Messrs. Craig, Taylor & Co., Stockton-on-Tees, an iron screw steamer of the following dimensions:—Length, 278 ft.; breadth, 37 ft.; depth, 19 ft. 8 in. The vessel has been built with a long raised quarterdeck, bridge extending to and including foremast and forewinch, short well and topgallant forecastle. She is fitted with web frames in after hold, and has double bottom for water ballast in holds and in peaks for about 500 tons. She will be fitted with four steam-winches and steam steering gear by Messrs. Roger & Co., of Stockton; patent windlass by Messrs. Emerson, Walker & Thompson Brothers, Linthouse; Messrs. Hastie's screw gear aft, and all modern improvements, so as to admit of rapid loading and discharging. The engines on the triple-expansion three-crank system, are being constructed by Messrs. Westgarth, English & Co., Middlesbrough, and are of the following sizes:—Cylinders 20 in., 33 in. and 54 in. by 36 in. stroke; two large steel boilers of 160 lb. pressure. The vessel has been built to the order of the Hudson Shipping Company (Limited), West Hartlepool, and was named the *Hessle*.

Chicklade.—On November 21st Messrs. Edward Withy & Co., West Hartlepool, launched from their yard at Hartlepool a large steel screw steamer, built to the order of Messrs. George Horsley & Son, West Hartlepool. The vessel is a fine type of a modern cargo boat, measuring over 310 ft. in length, and built throughout of Siemens-Martin steel, with a large measurement and deadweight capacity, and built to the highest class at Lloyd's. She has a long raised quarterdeck, short poop, long bridge-house, and a topgallant forecastle. The holds are fitted with iron grain divisions and iron cargo battens; all decks, deck erections, skylights, bulwarks, bulkheads, etc., are constructed of steel and iron. In the main and after holds the vessel is built on the web frame system, which gives a very strong type of ship and dispenses with all hold beams, thereby enabling the ship to carry cargoes of the bulkiest description. This type of construction has met with much favour among shipowners, and since it was introduced into this district by Messrs. Edward Withy & Co. nearly 100 vessels have been built by them of this design. Her cellular bottom is fitted all fore-and-aft for water ballast (Withy & Sivewright's patent). The greater portion of the plates are in 24 ft. lengths, making the structure of the ship very strong. Four steam winches, two donkey boilers, patent steam steering gear amidships, screw gear aft, direct steam patent windlass on forecastle, patent stockless anchors hauling up into hawsepipes, and all other modern appliances are fitted for the handy working of the vessel. The saloon and cabin, providing accommodation for passengers, captain, and officers, is handsomely finished in polished hardwood, with neatly painted panels, executed in a very effective style by the decorative staff of ladies employed by the firm. The vessel will be rigged as a two-masted fore-and-aft schooner, with polemasts, derricks, and all other cargo appliances for expeditious handling of cargo. She will be fitted with triple-expansion engines by Messrs. T. Richardson and Sons, Hartlepool. The hull and machinery have been constructed under the personal superintendence of Mr. Barron. On leaving the ways the vessel was gracefully christened *Chicklade* by Miss Cosie Richardson, daughter of Alderman Richardson.

LAUNCHES—Scotch.

Cometa.—On October 26th Messrs. Archibald M'Millan & Son launched from their dockyard at Dumbarton a steel twin-screw steamship of the following dimensions, viz.:—220 ft. by 32 ft. by 19 ft. 9 in. This vessel has been constructed to the order of Messrs. Hill, Gomes & Co., of Manchester, and is intended for their coastal trade in Brazil. Her engines are two sets of triple-expansion, having cylinders 12 in., 19 in, and 31 in. by 24 in., and are being supplied by Messrs. David Rowan & Son, engineers, Glasgow. Accommodation has been provided for a limited number of passengers, specially arranged for a hot climate. The vessel was named *Cometa* by Mrs. Hill.

Marionella.—On October 26th there was launched from the yard of Messrs. David MacGill & Co., Irvine, the hull of an iron screw steamer for the Spanish coasting trade. She was flying the Spanish colours as she took the water, and was named the *Marionella* by Mrs. MacGill. Her length is 113 ft.; breadth, 20 ft.; and depth, 9 ft. 6 in. She has a teak deck-house for day passengers, and has been built to the order of Messrs. Ross and Duncan, engineers, Glasgow, who will supply the engines.

Steel Screw Tug.—On November 2nd there was launched from the shipbuilding yard of Messrs. Scott & Co., Bowling, a steel screw tug 85 ft. by 16 ft. by 10 ft., class 100 A1 at Lloyd's Triple-expansion engines will be fitted on board by Messrs. Alley and MacLellan, Sentinel Works, Glasgow. The vessel is to the order of Messrs. Knowles & Foster, London, for foreign owners, and has been built under the superintendence of Mr. J. B. Cameron, Hope Street, Glasgow.

Flintshire.—On November 3rd there was launched from the yard of the London and Glasgow Engineering and Shipbuilding Company (Limited), Govan, a steel screw steamer, 2,950 tons gross, for Messrs. Jenkins & Co., of London, for their Eastern trade. Her dimensions are:—Length, 344 ft.; breadth, 40 ft.; and depth, 26 ft. 6 in. She has been built to class 100 A1 at Lloyd's three-deck rule, and will have accommodation for twenty-five first-class passengers in saloon on main deck aft. Great attenti n has been given to the ventilating and sanitary arrangements, and the vessel will be lighted throughout by electricity. The steamer will be supplied by the builders with triple-expansion engines, in the designing of which all the latest improvements have been adopted, and it is expected a high rate of speed will be attained. As she was leaving the ways the vessel was named the *Flintshire* by Miss Bessie Reid, Kilmardinny.

Charlois.—On November 5th there was launched from Messrs. Russell & Co.'s yard at Greenock a large steel screw steamer, the *Charlois*, for the petroleum bulk carrying trade. The vessel is 310 ft. long, 39 ft. beam, and 25 ft. 3 in. depth, and is capable of carrying about 3,800 tons of oil and 400 tons of coal on Lloyd's winter North Atlantic freeboard. The vessel is divided into eight oil-tight compartments, inclusive of the water-ballast tanks. The tanks have been subjected to tests before launching, which they stood satisfactorily. The vessel will be fitted with electric light, and is fitted with a powerful set of Worthington pumps and a duplicate set of Smith-Vail pumps, capable of discharging the entire cargo in about twenty-four hours. Triple-expansion engines will be fitted by Messrs. Duncan Stewart & Co., of Glasgow, the cylinders being 22 in., 36 in., and 58 in. diameter, with

a stroke of 42 in. There are two large single-ended boilers, the working pressure being 160 lb. The *Charlois* has been built to the order of Messrs. Hermann, Stursburg & Co., of New York, from the plans and specifications of Messrs. Flannery & Blakiston, consulting engineers, of Liverpool and London, who have also inspected the construction of the vessel.

Kalliope.—On November 6th there was launched from the yard of Messrs. Connal, at Scotstoun, a steel sailing ship of the following dimensions:—247 ft. by 30½ ft. by 23 ft., and measuring 1,650 tons. She has been built to the order of foreign owners, and is fitted with all the most recent improvements, both as regards her equipment and the means of loading and discharging cargo. As she left the ways she was named the *Kalliope*.

Bellarden.—On November 6th Messrs. D. & W. Henderson and Co. launched from their shipbuilding yard at Partick a steel screw steamer of over 2,700 gross tonnage, built to the order of Messrs. Bell Bros. & M'Lelland, Glasgow. The measurements are:—310 ft. long, by 39 ft. long, by 24 ft. deep. She is the sixth vessel of the same size put out by Messrs. Henderson & Co. to the order of the same firm. As she left the ways she was named the *Bellarden* by Mrs. James Currie, of Karachi.

Empress.—On November 6th a steel paddle steamer, built to the order of the Loch Lomond Steamboat Company, was launched from the yard of Messrs. Napier, Shanks & Bell, at Yoker. This steamer, named the *Empress*, is 165 ft. long by 20 ft. moulded breadth, is fitted with saloon deck-houses both before and abaft the engine space, and over the saloons is a continuous and unbroken promenade deck over 140 ft. in length. The accommodation will consist of dining-saloon forward on main deck, with bar and pantry and a stairway to the refreshment saloon on lower deck. The main saloon is aft on main deck, a separate compartment being fitted as a ladies' cabin. The machinery, embracing diagonal engines and haystack boiler, are being supplied by Messrs. D. Rowan & Son, Glasgow, and are expected to ensure for the vessel a high rate of speed. The vessel was named by Mrs. Allan, Dumbarton.

Pitcairn Island.—On November 15th there was launched from Messrs. Russell & Co.'s Greenock yard a steel sailing barque of 1,300 tons register, built to the order of Messrs. Stuart Brothers, of Glasgow. After the launch the vessel (named the *Pitcairn Island* by Mrs. Stuart, Hawthornden, Ibrox) was towed to the East India Dock, Greenock, where she will receive her masts, rigging, &c. The *Pitcairn Island* was built to the highest class at Lloyd's, and will be commanded by Captain Cornwell. After completion she will load for Sydney and Newcastle (N.S.W.).

Norfolk Island.—On November 20th there was launched from Messrs. Russell & Co.'s Port Glasgow yard, a steel barque of 1,300 tons register, 230 by 36 by 21·9, built to the order of Messrs. Stuart Brothers, of Glasgow. As the vessel left the ways she was named the *Norfolk Island* by Mrs. Banks, Dunoon. The vessel is a duplicate of the *Pitcairn Island*, recently launched for the same owners by Messrs. Russell & Co. After the launch the *Norfolk Island* was towed to a berth in Port Glasgow Harbour, where she will receive her masts, rigging, &c. The *Norfolk Island* was built to the highest class at Lloyd's, and will be commanded by Captain Thomas. After completion, she goes into Queen's Dock to load for Melbourne.

Earl of Aberdeen.—On November 21st there was launched from the shipbuilding yard of Messrs. Hall, Russell & Co., Footdee, a steel screw steamer named the *Earl of Aberdeen*, for the Aberdeen, Newcastle, and Hull trade. The steamer's dimensions are:—Length, 220 ft.; breadth, 30 ft.; and depth, 15 ft.; with a gross tonnage of 760. She will be fitted with triple-expansion engines.

Enrique Barrzo.—On November 21st the Grangemouth Dockyard Company launched from their shipbuilding yard at Grangemouth a handsomely-modelled steel screw steamer, built to the order of Messrs. Laufrance & Ramo, Monte Video, under the superintendence of Mr. J. R. Cameron, Hope Street, Glasgow. Dimensions:—Length, between perpendiculars, 200 ft.; over all, 208 ft. by 32 ft.; beam, 10½ ft.; depth moulded, 17½ ft.; and poop deck. She is designed to carry a large deadweight cargo on an extremely light draught, and is intended to trade on the River Plate and coast of Brazil. On leaving the ways she was named the *Enrique Barrzo* by Mrs. Miller, wife of Mr. Miller, of the dockyard. A cake and wine lunch was served in the company's offices, when the usual toasts were proposed and responded to.

Reina Maria Cristena.—On November 21st Messrs. William Denny & Brothers launched from their Leven shipyard, Dumbarton, the *Riena Maria Cristena* (s), which they have constructed for the Compania Transatlantica of Barcelona and Cadiz. This vessel is similar to the one launched recently by them for the same company, and the dimensions are 400 by 48 by 32. She will have a gross tonnage of about 4,600 tons, and all modern perfections in the way of hydraulic gear, electric light, and refrigerating machinery. Her engines are of the latest and most efficient type, triple-expansion, by Messrs. Denny & Co. Steam will be supplied by three double-ended boilers with 18 furnaces, at a working pressure of 170 lb. per square inch. Forced draught will be fitted, and she will develop a speed of 17 knots per hour. The ceremony of naming the vessel was performed by Dona Ferrer de Villoch.

LAUNCHES.—IRISH.

Steam Ferry Boat.—On October 25th, at high water, there was launched from the Belfast Shipyard (Messrs. Workman, Clark & Co., Limited) a new steam ferry boat for the Belfast Harbour Commissioners. This boat is intended to take the place of No. 1 Ferry boat, which is to be shifted down to the station at the corner of the Abercorn Basin. The new vessel is similar in design to the others (which are of the Clyde steam ferry type), but is of somewhat larger size, the dimensions being—56 ft. long over all; breadth, 12 ft. 6 in.; depth, 4 ft. The hull is of steel, with high wood bulwarks; the deck, seats, and rail are of teak. The machinery is being supplied by Messrs. D. & W. Grant, Belfast.

Lord Londonderry.—On November 17th a steel screw steamer, built for the Irish Shipowners' Company (Limited) (Messrs. Thomas Dixon & Sons, managers), by Messrs. Harland and Wolff, was launched from the Queen's Island, Belfast. The dimensions of the vessel, which is named *Lord Londonderry*, are as follows:—312 ft. long; breadth of beam, 39 ft.; depth moulded, 27½ ft.; gross register, 2,400 tons; is classed 100 A1 at Lloyd's; and the engines are 1,200 I.H.P. The vessel is of the same class as the two sister-ships built for the same company by Messrs. Harland & Wolff. It is intended to employ her in the East Indian and American trade.

Cupica.—On November 23rd there was launched at high water from the shipbuilding yard of Mr. Charles J. Bigger, Foyle Shipyard, Londonderry, a very handsomely modelled 1,200 ton steel sailing barque of the following dimensions:—Length, 218 ft.; breadth, 36 ft. 3 in.; depth of hold 22 ft. She has been built to the order of Messrs. W. H. Ross & Co., Liverpool, and is the third barque built this year by Mr. Bigger for them. As the barque left the ways she was gracefully christened the *Cupica* by Mrs. McMaster. The *Cupica* is a sister ship to the *Paul Isenberg*, which was launched a few weeks ago from the Foyle Shipyard.

TRIAL TRIPS.

Dabulamanzi.—On October 24th this vessel, whose engines have recently been converted into triple-expansion by Messrs. Hall, Russel & Co., the original builders of the ship and engines, left Aberdeen on her trial trip. Her cylinders were formerly 33 in. and 64 in. diameter, with a stroke of 42 in.; another cylinder, 21 in. diameter, has now been added to the foreside of the old engine, and a liner has been inserted in the low-pressure cylinder, reducing its diameter to 56 in. The alterations have been carried out under the superintendence of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool, and the vessel, which is owned by Messrs. John S. Rennie & Sons, of London and Aberdeen, is of the following dimensions:—Length, 260 ft. B.P.; beam, 35 ft. 4 in.; depth of hold, 21 ft. 2 in. On her trial the vessel was in ballast trim, wind S.S.W., fresh, and she made two runs on the measured mile averaging 11½ knots, her steam pressure being 160 lb., revolutions 83, indicating without effort 1,189 H.P. The vessel arrived in London on 26th, and at once proceeded to her loading-berth in the London Docks for Natal direct.

Pundua.—On October 25th the *Pundua* (s), 3,300 tons, recently built for the British India Steam Navigation Company by Messrs. A. & J. Inglis, Pointhouse, Glasgow, completed her official trials. Over various measured distances an average speed of 13½ knots was maintained. The trial was considered in all respects satisfactory.

Marple. On October 25th the new twin screw tug *Marple*, just completed by Earle's Shipbuilding and Engineering Company, Limited, for the Manchester, Sheffield, and Lincolnshire Railway Company, was taken down the Humber on her trial trip. This vessel has been built of iron for the owners' passenger service between Grimsby and the Continent, and is intended to be used as harbour tender to their larger steamers, her dimensions being 90 ft. by 20 ft. by 8 ft. 6 in., and there is provision for water ballast in a tank forward to assist in trimming to a suitable draught. An exhaustive trial was made to ascertain the speed and power of the ship, as also of the efficiency of the salvage and fire service with which she has been equipped, and the results were in all respects satisfactory.

Giang Ann.—On October 25th the steel screw steamer *Giang Ann*, built and engined by Messrs. Wigham Richardson and Company, of the Neptune Works, Low Walker, made a successful trial trip at sea. The vessel was fully loaded and equipped complete for a voyage to Singapore, and during a continuous run of five hours maintained an average speed of nearly 12 knots, being considerably in excess of the guarantee. Throughout the run, which was made without a single stop, the engines worked with perfect smoothness and to the satisfaction of all concerned. The *Giang Ann* has been built for Mr. Jan Beng Wan, of Singapore, through Messrs. Paterson, Simons & Company there, and is intended for the local passenger and cargo trade. Her cabins are fitted for first and second class passengers, and a continuous shade deck of teak as well as the main deck gives plenty of space for deck passengers. The *Giang Ann* is commanded by Captain Wooldridge.

Lancelot.—On October 27th the steel screw steamer *Lancelot*, built by the Tyne Iron Shipbuilding Company, Limited, of Willington Quay-on-Tyne, for Francis F. Reid, Esq., of Leith, went for a trial trip off the mouth of the Tyne. The vessel, which is a handsome three-decked steamer, has most complete arrangements for the rapid loading and discharging cargo, including five powerful steam winches, large multitubular donkey boiler, steam windlass and steam and hand steering gears. She is 290 ft. long, by 40 ft. broad, by 27 ft. deep, and carries nearly 4,000 tons deadweight. She is fitted with powerful triple-expansion engines with cylinders 24 in., 37 in. and 62 in. by 42 in. stroke, 150 lb. pressure, by Messrs. Wigham, Richardson & Co., of the Neptune Works, Newcastle-on-Tyne, and on her trial attained a mean speed of 12½ knots.

Iona.—On October 30th the new steam trawler *Iona*, owned by Messrs. Pickering & Haldane, was taken down the Humber and out to sea, but, owing to the foggy state of the weather, the ship was not taken on the measured mile, as no landmarks could be seen. The engines, which are of Messrs. Charles D. Holmes & Co.'s well-known type for steam trawling, worked faultlessly the whole of the day without the slightest signs of heating, the average revolutions being 108 and the speed of the ship 10½ knots. The contract for this vessel was placed in the hands of Messrs. C. D. Holmes & Co., engineers, the hull being built to their order by Messrs. Cochrane, Cooper & Schofield, of Beverley, this being the fourth vessel which the latter firm have built for the same owners. Her dimensions are:—Length, 100 ft.; breadth, 20 ft. 6 in.; depth to top of floors, 11 ft. This vessel has been built under special survey to class 100 A1 at Lloyd's with various special extras in hull and machinery, found by experience to be desirable for this class of vessel.

Anglia.—On October 31st the new Anchor liner *Anglia*, built and engined by Messrs. D. & W. Henderson & Co., Glagow, for Messrs. Thomas Henderson & Son, went on her speed trials on the Clyde, and attained very satisfactory results. The vessel, which is primarily intended for cargo trade, is so arranged internally that a large number of first and second-class passengers may be arrranged for. The length is 340 ft., breadth 43 ft., and depth 30.1 ft., with a tonnage of 3,287 and a carrying capacity of 4,500 tons on about 24 ft. draught of water. She is constructed of steel with three decks of iron covered with teak-wood. The engines are of the triple-expansion type, with cylinders 24 in., 40 in., and 66 in. diameter respectively, and having a stroke of 48 in. They are fitted with Hackworth valve gear overhead, which reduces the fore-and-aft length, making it 24 ft. with plenty of spare room. The condensing surface is 2,807 square feet. The boilers are two in number, both single-ended, 15 ft. 6 in. in diameter and 11 ft. 6 in. long. There are eight furnaces, 3 ft. 3 in. in diameter, with a total grate surface of 156 square feet, and a total heating surface of 4,911 square feet. The propellor, which is of cast iron, is 16 ft. 6 in. diameter, with a pitch of 17 ft. 3 in. The speed trials were in stormy weather, with heavy showers of rain and a stiff breeze. The vessel "ran the lights" twice—steamed between the Cloch and the Cumbrae Lighthouses, a distance of 13.3 knots. In the outward journey she took 66 minutes, in the homeward 67 mintues, giving a mean speed of 12.38 knots, and that with a load of 1,200 tons of cargo on board. The steam pressure in the boiler was 154 lb., and with the engines working at 73½ revolutions per minute the pressure in the first cylinder was 86.4, in intermediate 28.72, and in low-pressure 12.5, and the I.H.P. by the three was 696, 643, and 762 respectively, or a total of 2,101—13.46 per foot of firegrate, .427 per foot of heating surface, and .748 per foot of condensing surface. It is expected that the vessel will steam at the rate of 10½ knots on 25 tons of Scotch coal per day.

Queen Elizabeth.—On November 1st, this vessel, which was launched at Messrs. Stephen's works, Linthouse, Glasgow, on 23rd ult., and has since been loaded in the harbour, ran the trial trip with a large company of owners and friends on board. Everything worked well and smoothly, and the average speed attained was fully 10½ knots, which was considered highly satisfactory. The vessel had about 4,000 tons dead weight on board, and immediately after the trip proceeded on her voyage to Bombay under charge of Captain Jack.

Maggie Walker.—On November 3rd the trial trip of the new steam trawler, the *Maggie Walker*, took place, which was launched from the shipbuilding yard of Messrs. A. Hall & Co., Aberdeen, some weeks ago. The weather was somewhat boisterous, and the sea-going qualities of the vessel were well tested, and gave every satisfaction. The trawler, under steam, attained a speed of 11 knots.

Strathblane.—On November 3rd the *Strathblane* (s), which has been built by Messrs. Russell & Co., for Messrs. Burrell and Son, Glasgow, proceeded down the Firth, when a series of trials were gone through. The engines, which were constructed by Messrs. James Howden & Co., worked to the entire satisfaction of all concerned, a mean speed of 10 knots having been attained. The boilers and machinery are constructed on the "forced blast" principle.

Princess Josephine.—On November 6th this fine paddle-steamer, built for the Government of His Majesty the King of the Belgians by Messrs. William Denny & Brothers, of Dumbarton, completed her official trials by four consecutive runs (two against and two with the tide) between the Cloch and Cumbrae lights. As a mean of these trials, upwards of 21 knots per hour was obtained, the vessel, notwithstanding most unfavourable weather—a strong north-east wind blowing all the time—earning the same large premiums for speed as in the case of the *Princesse Henrietta*, belonging to the same Government, and built by the same firm. The *Princesse Henrietta* was tried in June last, and until the appearance of this new "flyer" was undoubtedly the fastest passenger steamer afloat. The trials were superintended, on behalf of the Government, by Monsieur Michel, President of the Commission and Inspecteur-General de la Marine, Brussels; Monsieur Delcourt, Ingenieur-en-Chef, Directeur, of Antwerp; Monsieur Verbrugghe, Inspecteur Administration de la Marine; Monsieur Ecrevisse, Lieutenant du Vaisseau, superintendent of the mail packet service between Ostend and Dover; Monsieur Lecointe, Ingenieur, Directeur of the Arsenal at Ostend; and Monsieur Thienpondt, Chief Ingenieur in the Dover and Ostend mail packet service, who has been superintending the erection of the machinery for this vessel, and will take his place of Chief Engineer on board of her. The commission expressed themselves highly satisfied with the vessel, and confident of the additional prestige which will be gained by their line through her acquisition.

Winstanley.—On November 8th the *Winstanley* ran her trials on the measured mile at Skelmorlie, when she attained the mean speed of 9¼ knots, fully laden with 500 tons deadweight on board. This vessel is owned by Captain John Weatherill, of Messrs. Mackenzie & Co., of Dublin, was recently launched by the Ailsa Shipbuilding Company, Troon, and is fitted with triple-expansion engines of 500 I.H.P., by Mr. William Kemp, Govan.

Ardle.—On November 10th this vessel, recently launched from Camperdown Shipyard, Dundee, made a trial trip down the river. Owing to the south-easterly gale blowing, it was not deemed prudent to go beyond No. 3 buoy. The river was very boisterous, and the vessel's sea-going qualities were well proved, but a satisfactory test of speed could not be made. The machinery worked smoothly.

Adirondack.—On November 14th the screw steamer *Adirondack*, which has been built by Messrs. Aitken & Mansel for Messrs. Leech, Harrison & Forwood, Atlas Line of mail steamers between New York and the West Indies, went on her trial trip. The *Adirondack* is a vessel of 2,100 tons gross, and special arrangements have been made for the comfort and convenience of passengers, the ventilation being most complete. The machinery, of the triple-expansion type, has been constructed by Messrs. John & James Thomson, Finnieston Engine Works, and developed on trial trip 1,700 H.P., with a speed of 13 knots. The vessel was loaded for sea, and after the trial trip proceeded for New York to take her station.

South Briton.—On November 14th the screw steamer *South Briton*, built by Messrs. Schlesinger, Davis & Co., of Wallsend, for Messrs. Gibb & Lee, of Cardiff, was taken to sea for her trial trip. The vessel is 260 ft. long, by 37 ft. beam, and 18 ft. 11 in. in depth, and is fitted with water-ballast tanks throughout. She was loaded with a cargo of 2,400 tons of coal. Her engines, which are on the triple-expansion system, each cylinder being separate, are 150 N.H.P., and were supplied by Messrs. Ernest Scott and Co., Newcastle, the diameter of the cylinders being :—h.p., 19 in. ; i.m., 38 in. ; l.p., 53 in. by 36 in. stroke. The boilers were built by Mr. J. T. Eltringham, of South Shields, and are 12 ft. 5 in. diameter by 10 ft. long, with Fox's patent furnaces, and carry steam at 160 lb. pressure. The machinery worked throughout without a single hitch, the revolutions being 65, vacuum 27½. The weather was very unsatisfactory for a speed trial, but the approximate speed was about 10 knots. The machinery was thoroughly tested, and gave every satisfaction.

British Prince.—On November 15th the screw steamer *British Prince*, which has been built at Sunderland by Messrs. Short Brothers, had her trial trip. Her dimensions are:—Length, 292 ft; breadth, 39 feet; and depth, 21 ft. 2 in.; and she is fitted with the latest improvements for quick loading and discharging of cargo. The engines have been supplied by Mr. George Clark, of Southwick, and are of 200 N.H.P. In the charge of Captain Innes she proceeded to Cardiff to take in her cargo for the River Plate.

Daphne.—The new composite sloop *Daphne*, recently built at Sheerness Dockyard, has completed her natural draught trials. She was tested under the new regulations, which provided for a twelve hours' full-power trial at sea, and the results are stated to have been of a most successful character. Working at 150 revolutions per minute, the engines averaged 1,463 H.P. (63 H.P. in excess of the power contracted for), with a mean speed of 13.60 knots. The machinery of the *Daphne* was supplied and fitted by the Greenock Foundry Company at a cost of £15,150.

Nymphe.—The new sloop *Nymphe* had last month a twelve hours' trial of her machinery under natural draught in the Channel. The engines, which are supplied by the Greenock Foundry Company, are of the triple-expansion type, having cylinders 18½ in., 29½ in., and 43½ in. in diameter respectively, and a stroke of 24 in. The boiler pressure is 140 lb., and they are constructed to develop 1,400 horses, with open stokeholds, and 2,000 with closed stokeholds. The vessel was full of coal, and she was brought down to her load draught of 11 ft. forward and 13 ft. 8 in. aft by the addition of iron ballast. At the conclusion of her trial the following means were worked out:—Boiler pressure, 127½ lb.; revolutions, 149; collective H.P., 1,440, being 40 horses beyond the contract. The consumption of fuel was 2 lb. per unit of power, and the average speed realised during the whole time the *Nymphe* was under way was (as measured by patent log) 12 points 8 knots. With the exception of an indifferent vacuum, the results were very satisfactory. The final trial under forced draught was even more satisfactory than the previous ones with open stokeholds. The trial was continued for four hours and was watched on behalf of the Admiralty by Mr. Bakerell. The vacuum, which was faulty on the first occasion, was raised to 21 in. with an average of 135 lb. of steam pressure in the boilers, and a mean of 169 revolutions. A total of 1,013.24 horses were developed by the starboard and 1,062.8 by the port engine, making a collective I.H.P. of 2,076, or 76 beyond the contract. The mean speed realized was just below 14½ knots. The air pressure in the stokeholds registered 2 in. in the water gauge, the consumption of coal being somewhat large. The Admiralty have consented to provide the *Nymphe* on demand with one of Sir William Thomson's compasses.

Brunel.—On November 17th the new screw steamer *Brunel*, built by the Tyne Iron Shipbuilding Company, Willington Quay, for Mr. James Wait, of Newcastle-on-Tyne, went to sea for a trial trip. The vessel, which is 287 ft. long, 37 ft. broad, and 23 ft. 6 in. deep, is a splendid specimen of cargo boat, and carries a cargo of about 3,100 tons deadweight. The steamer is equipped with all the latest improvements and appliances for efficiency and economy in handling cargo, etc. She is fitted with powerful triple-expansion engines, having cylinders 22 in., 36½ in., and 60 in., with a stroke of 39 in., made by the North Eastern Marine Engineering Co. at their Wallsend works. The engines and boilers are fitted with every appliance for securing efficiency, including Smillie's feed-heater, evaporator, etc. During the trial the engines ran with perfect smoothness and regularity, and gave every satisfaction, not the slightest hitch of any kind occurring during the day's proceedings. The vessel was taken over the measured mile, and showed a mean speed of 10 knots, laden with 3,100 tons of coal. After a satisfactory trial the steamer proceeded on her maiden voyage to Barcelona. During construction the vessel and machinery have been inspected by Mr. Baird, of North Shields.

Peninsular.—On November 21st the new P. & O. screw steamer *Peninsular*, built and engined by Messrs. Caird & Co., Greenock, for the Peninsular and Oriental Steamship Company, went down the Firth of Clyde on a trial cruise. The vessel, which had been lying in the Victoria Harbour since she was launched, left the dock about noon, and proceeded down the river. The weather was not very suitable either for the trial of the ship or for those present, as there was blowing a cold wind, accompanied by frequent heavy showers of rain. The superintending engineers were so satisfied with the performance of the engines while steaming down and up firth that a run on the mile was not considered necessary. The engines worked to their full power, and did so "quietly." Her principal dimensions are: Length, 410 ft.; breadth, 48 ft.; depth, 37 ft.; having a gross burthen of 5,500 tons. The construction of the ship has been carried out under the personal superintendence of Mr. H. J. Taylor, the superintendent of the P. & O. Company at Greenock. The engines—the construction of which has been supervised by Mr. J. Pettigrew, superintending engineer of the company—are supplied from the builders' engineering establishment in Arthur Street, and are on the inverted direct-acting compound triple-expansion principle of the most improved type, indicating 5,000 effective H.P. Her displacement on a load draught of 25 ft. is 9,000 tons, with a deadweight carrying capacity of about 4,200 tons. The total cubic capacity below the main deck available for cargo is about 220,000 ft. The *Peninsular* is built entirely of Siemens' mild steel in accordance with Lloyd's rules for the 100 A1 spar deck class. She has five decks—viz., the hurricane deck, spar deck, main deck, lower deck, and orlop deck—all of steel. The first two are sheathed with finely-grained teakwood, and the other three with the best pitch pine. The beams of all the decks are of the patent Butterly section, of great strength with wide top flanges, and presenting a neat appearance to the eye, compared with those formerly in use. The masts and yards are of steel, and the vessel is rigged as a three-masted schooner. She has ample accommodation for 180 first-class and 32 second-class passengers; and is also constructed in accordance with the requirements of the Admiralty list, so that she could be easily converted into a first-class Government transport. She is divided into eight water-tight compartments, and the bulkheads have been so stiffened that it is impossible for them to give way to any pressure that can come on them from either side, and so designed that if any two compartments filled she would still be in a seaworthy condition. It may be pointed out here that all the bulkheads are carried right up to and worked from the spar deck, that being a good height above the load water-line. The bulkheads are furnished with sliding doors, so that the accommodation is not in the least degree impeded by them. Standing aft on the spar deck one is struck with the graceful sweep and perfect proportions of the stern. She is fitted up with union ridge poles for the great awnings which will cover the vessel from stem to stern when she is making her way under hotter skies than our own. The powerful cargo machinery, by Lord Armstrong's firm, on the spar deck is all on the hydraulic principle, the noiseless working of which is a boon which all passengers appreciate in a marked degree. The smoking-room on the spar deck aft is a beautiful and well-lighted apartment, some 22 ft. square, and finished off with splendid Tynecastle tapestry wall hangings. The settees are all reversible—one side upholstered in mosquette and the other side caned. The tables, with marble tops, have each tumbler racks placed underneath, and the elegantly upholstered furniture is in perfect keeping with the rich character of the surroundings. Further forward is the music-room, in the design and ornamentation of which much artistic taste has been displayed. The

beautifully carved oak roof, the richly stained glass windows and panels, the splendour of the Tynecastle tapestry, and the finely modelled elliptical screen which faces the massive and handsome double oak staircase leading to the first-class dining saloon below, give the music-room a charming appearance. The entire upholstery work in the vessel has been executed by Messrs. J. G. Rowan & Co., of Greenock—a firm which of late years has devoted special attention to this class of work. The sofas and settees are richly upholstered with claret and gold silk Bruché velvet. Handsome silk curtains to suit are placed on the entrance doors, and all the windows have curtains of the same material, with silver-mounted rods and rings. The floor is carpeted with a superb Axminster carpet in subdued colouring. The piano is from the well-known establishment of Brinsmead & Sons, London. We may mention here that the windows of this and the other principal apartments of the vessel are fitted with Stones' patent pivot side-lights. At the after end of the music-room is a magnificently stained glass dome, some eight feet in diameter and twenty-six feet in height, which gives adequate light and ventilation to the dining saloon below. Further forward on the spar deck, and between the engine and boiler space, is a large airy, and well-equipped galley, the cooking ranges being those of Benham & Sons, London. There are also large bakeries and sculleries, and a spacious bar fitted with every requisite. Forward of these are the cabins, dining-saloon, and smoking-room for the second-class passengers. Their accommodation leaves nothing to be desired, each cabin being supplied with porcelain stoneware, plate-glass mirror, mahogany toilet rack, &c. The second-class smoking-room and dining saloon are elaborately furnished apartments, and supplied with every comfort and convenience. The post-office, hospital, lamp-room, butcher's shop, and native galley, are all placed forward, as are also the quarters for the crew. The accommodation for the first-class passengers is principally on the main deck, in state-rooms, which are most luxuriously fitted up. Brussels carpets of the best quality, in two shades of terra-cotta, cover the floor. The folding berths are Messrs. Crosbie & Co.'s patent, and Birmingham netting racks are placed in each for the use of the passengers. The windows are all fitted with spring blinds, and each cabin has a patent lavatory, and furnished with whatnots, chests of drawers, mirrors, toilet racks, &c. There are numerous plunge or spray baths, constructed of marble slabs, beautifully polished. On the main deck, also, are the officers' cabins, which are all well appointed and comfortably furnished. But the principal apartment here is the first-class dining saloon, which, as we have already pointed out, is reached from the music-room by a free, open, and handsome double staircase of solid oak. This saloon extends the whole width of the ship. Rich Wilton carpets cover the floor, and the dining chairs (of which there are 124), settees, and sofa lounges are upholstered in a beautiful shade (old rose) of frieze Utrecht velvet. Rich silk tapestry curtains are placed over the entrance door, and all the windows are hung with curtains of the same costly material. The seats and backs of the dining chairs are all made reversible, being upholstered on the one side and caned on the other, the latter for use in hot climates. The P. and O. Company were the first to introduce this arrangement, which is the patent of Messrs. J. G. Rowan & Co., Greenock. The beautifully-carved oak fittings and mountings, the luxurious character of the Tynecastle tapestry wall hangings, and the harmonious blending of the wealth of colour exhibited in the many and variegated stained-glass windows and panels, all combine to form a picture on which the eye lingers with pleasure. Passing a number of state-rooms, we come upon the surgery, complete in every respect, and the barber's shop, which is fitted up with every convenience. The *Peninsular* is lighted throughout with the electric light by Messrs. Siemens Bros. & Co., of London. The cabin lights can all be switched off or on singly at the will of the passengers. The driving machinery consists of two compound slow-speed dynamo machines by the same firm, each coupled to and driven direct by a vertical compound Tangye engine. Each machine is capable of working the whole number of lamps on board. There are also two search-lights, one for the bow and the other for the top bridge, for going through the Suez Canal at night. On the lower and orlop decks are spacious store rooms, wine cellars, baggage, mail, and bullion rooms. All the decks are drained by large scuppers, those on the decks above the water-line discharging through the ship's side, well down, so as to keep the hull clean. Where the decks are under the water-line the scuppers discharge into the bilges, where an extensive system of bilge suctions connected to the main engines and to several donkey engines, throw the water overboard again. Powerful Tangye pumps are also used for the same purpose. The salt water supply to baths, w.c.'s, &c., is also very extensive, giving a constant flow of water to all parts of the ship. For washing the decks large nozzles and hose are supplied with branches and hydrants on the passenger decks in case of fire. A powerful fire extinguishing apparatus is also placed in the holds. The fresh water system is most elaborate, and extends from one end of the ship to the other, supplied from large tanks built in with the framing of the ship, and placed both forward and aft, whence the water is circulated through numberless pipes to the galleys, pantries, ice-house, &c., by a large steam pump, with additional hand pump in case of breakdown, or in harbour when the steam is off. The baths, with their spray, douche, and sitz arrangements, can be supplied with hot water from a separate tank and pipes. The vessel is fitted with splendid refrigerating chambers and engines, enabling fresh meat and fish of all kinds to be kept on board in the hottest climates. Her fresh water tanks are capable of holding about 30,000 gallons. The boat equipment of the *Peninsular* is of the most complete description. They are ten in number—six lifeboats, two cutters, one gig, and a steam launch, the latter being capable of steaming at the rate of ten knots an hour. A steam windlass by Emerson & Walker is fitted on board for raising and lowering the anchor, and the steam steering gear has been supplied by Messrs. Muir & Caldwell, Glasgow. Messrs. Caird & Co. have still five vessels to launch for the P. and O. Company, namely, the *Oriental*, of 5,500 tons (sister ship to the *Peninsular*), and the *Bombay*, *Canton*, *Hong Kong*, and *Shanghai*, all of 3,400 tons each. With the completion of this contract, Messrs. Caird and Co. will have built during the last fifteen years no less than 135,000 tons of shipping for the Peninsular and Oriental Steam Navigation Company, whose magnificent fleet of steamships are the perfection of ocean travelling.

Captain Wyatt, who formerly had charge of the *Chusan*, *Coromandel*, *Carthage*, and many other vessels of the Company's fleet, will take command of the *Peninsular*. He is an able and experienced officer, a general favourite with the passengers; and under his care we have no doubt that the *Peninsular* will prove a successful and speedy ship.

Glanystwyth.—On November 26th the s.s. *Glanystwyth*, recently launched by Messrs. Palmer's Shipbuilding Company, was taken on her trial trip. The vessel is on the long bridge system, and is specially adapted for the Black Sea trade. She is 265 ft. long, 36 ft. 9 in. beam, and 21 ft. depth of hold, and will carry 2,700 tons deadweight upon Lloyd's freeboard. Her machinery has cylinders 20 in., 33 in., and 54 in. diameter by 36 in. stroke, and these are supplied with steam from two boilers, each 12 ft. 3 in. diameter by 10 ft. 6 in. long. The vessel was put upon the measured mile off the Tyne, and the engines developed 1,011 H.P., driving the ship at a maximum speed of 11.04 knots and a true mean speed of 10.55 knots, the machinery working throughout in a most satisfactory manner. The vessel has been built to the order of the Glanystwyth Steamship Company of Aberystwyth and London, and has been constructed under the superintendence of Messrs. Flannery, Baggallay & Johnson.

Darien.—On November 26th the *Darien*, a steel screw steamer built by Messrs. Barclay, Curle & Co., Limited, Glasgow, for the West India and Pacific Steamship Company, Limited, went on her speed trials on the Firth of Clyde. The ship, which is similar to the *William Cliff*, quite recently built by the same firm for the same company, is for the passenger and cargo trade between Liverpool and the West Indies. The dimensions are 370 ft. length over all, 41 ft. breadth, and 27 ft. depth of hold, with a gross tonnage of 3,375 tons, and a deadweight carrying capacity of 4,500 tons. The engines are of the triple-expansion type, with cylinders 28 in., 44 in., and 74 in. in diameter respectively, with a 51 in. stroke of piston. The boilers are two in number, both double-ended, 14 ft. 3 in. in diameter by 18 ft. long, the working pressure being 150 lb. to the square inch. The furnaces have Fox's corrugated flues, and are 3 ft. 8 in. in diameter. The propellor is 17 ft. 9 in. in diameter, with a pitch of 22 ft. 6 in. On trial the ship attained speeds of 14.2 and 14.4 knots per hour with the engines working at seventy revolutions per minute.

R.M.S. Tartar.—The Union Steamship Company have received news from Dakar (Cape Verd) that the *R.M.S. Tartar* which left Cape Town on October 31st with the homeward Cape of Good Hope and Natal mails, has met with a slight accident which will delay her arrival home. It is stated that the couplings of the after length of the shaft have broken, but the shaft has been repaired sufficiently to permit the *Tartar* to continue her voyage at reduced speed. Her power to do this is attributed to the fact that all the Union Company's mail steamers are provided with Thomson's patent shaft couplings.

Correspondence.

*[It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—*Ed. M. E.*]*

NOBLE'S PATENT REVOLVING VALVE.

To the Editor of The Marine Engineer.

Sir,—In the notice of my Patent Revolving Valve, which you were so kind as to give in your November number, there are some indicator-diagrams showing considerable throttling of the steam.

As the cause of this throttling is not stated in the notice, and as it may be considered due to my valve, will you allow me to say that when the diagrams were taken the engine was driving only about half-a-dozen lathes and planing machines, and the load upon it was small? There is a long steam pipe, with a stop valve on the boiler, a reducing valve, and a stop valve close to the engine, and this second stop valve was opened only about one-sixteenth of an inch, as that was found to be enough for the speed required. The area through this valve was not so much as one-two-hundredth part of the piston area; whereas that of the inlet ports in the valve is one twenty-sixth of the piston area.

Your publishing this will oblige,

Yours truly,
K. D. NOBLE.

November 13th, 1888.

TRIPLE *versus* QUADRUPLE EXPANSION ENGINES.

To the Editor of The Marine Engineer.

Dear Sir,—As there is at the present time a considerable diversity of opinion as to the comparative merits of triple and quadruple expansion engines, just as there was a few years ago regarding compound and triple when the latter were introduced, we think the enclosed copy of a letter, which we have received from the owner of the yacht *Skeandhu*, may appear to you worth publishing. The *Skeandhu* was fitted with our improved type of quadruple engines—not tandem—having all the four cylinders on one plane, with piston valves in centre of group, and two cranks directly *opposite* to each other, which gives a perfectly balanced engine, having a motion equal to an engine with four right-angle cranks in line. The engines indicated 128 H.P. on trial, which drove the yacht a good 10½ knots per hour.

With 100 I.H.P. she steamed 10 knots per hour, and the consumption on this I.H.P., as you will see from Mr. Douglas's letter, is only 1·12 per I.H.P. per hour, which compares most favourably with anything yet achieved by the best type of triples. The coal used was Scotch, not Welsh.

We may explain that the first portion of Mr. Douglas's letter refers to an advantage which our quadruple engine possesses, which, in the event of anything happening to one of the cranks or its connections, enables the other cranks to be wrought either by the two fore or two aft cylinders, as might be required; this giving, in such a case, an effect equal to a pair of compound engines with cranks at right angles.

Hoping that you may consider Mr. Douglas's letter worth inserting,

We are, yours truly,
FLEMING & FERGUSON.

November 14th, 1888.

Douglas Support, Coatbridge,
November 9th, 1888.

Messrs. Fleming & Ferguson, Paisley.

Gentlemen,—I am anxious to make an appointment with you to visit the *Skeandhu* one day, now that she is laid up, with a view to show the engineer how to throw the fore-and-aft portions of the engines out of gear with each other, as it would greatly enhance their practical value; but as they stand, and after a season's work in all kinds of weather and under various circumstances, they have fully come up to all I was led to expect. In fact, I do not know anything in which an improvement can be made. The reversing and starting gear never fails—in fact, a child could work them; and as regards absence of vibration, it is the nearest thing to a sailing ship that could be experienced. My friends have been particularly struck with this; and as all the weight has now been brought so low, she really never rolls. I certainly would never think of having a triple-expansion after my experiences of this summer.

My donkey-engine, which you fixed for me, I found useful in filling the boiler with fresh water from a boat which I bring alongside full. We merely disconnect it from the pipe which would bring in sea-water, and put an india-rubber pipe over the side into the boat.

The consumption of fuel is about a hundredweight per hour; with this we can get an average speed of 10 knots.

In coming home, for instance, we did 120 knots in twelve hours less ten minutes.

Yours truly,
(Signed) HOLTS. D. C. DOUGLAS.
(True copy.)

Miscellaneous.

The United Steamship Company.—The United Steamship Company, Copenhagen, which is a very large and active concern, has again ordered a new steamer from the Burmeister and Wain Shipbuilding and Engineering Company, Copenhagen. She is to be about 700 tons, and is intended for the new line between Copenhagen and Portugal and Spain. The Swedish Steamer Company, Gotland, has just decided to order a new fast steamer, similar to their steamer *Gotland*, but suitable for winter traffic. Kockum's Engineering Company, Malmö, Sweden, has during the last few days contracted for new boilers to the steamers *Nore* and *Transit I.* The firm has also been very busy with repairs of various steamers lately, and also secured a good order for machinery for a new wood pulp manufactory in Wermland.

Feat of very Rapid Docking.—The new off-shore floating dock just completed at Hamburg by the Reiherstieg Schiffswerfte und Maschinenfabrik was on November 14th formally tested by its designer, Mr. Standfield, on behalf of the engineers, Messrs. Standfield & Clark, of Westminster. A vessel weighing 2,000 tons was docked in the remarkably short time of only thirty minutes. This is the most rapid docking feat on record, and as it occurred when all the machinery was quite new and the river covered with ice, we may expect to hear that even this rapid record will be easily beaten by regular performances. The adjustable breast and bilge shores enable the vessel to be quickly and thoroughly supported without any wedging up or cutting of timber whatever.' In fact not a sound of a hammer is heard during the operation. The company owning this dock is in the fortunate position of being extremely busy, having just laid down its 372nd and 373rd keel, and having sufficient work in hand to carry it over next year.

The Pigmy.—The new composite gunboat *Pigmy*, 6, recently built at Sheerness Dockyard, has satisfactorily completed her natural draught trials. Her machinery was supplied and fitted by the Naval Construction and Armaments Company. The results of her 12 hours' trial at sea were as follows:—Draught of water forward, 10 ft.; aft, 12 ft. 8 in.; mean boiler pressure, 138·25 lb. to the square inch; mean vacuum in condensers, 26·5; mean revolutions, 165·3 per minute; mean I.H.P., 778 (58 in excess of the contract); *maximum* I.H.P., 838 (118 in excess of the contract). Throughout the trial the engines worked well. The boilers gave a plentiful supply of steam without any sign of priming. The *Pigmy* is to be taken to sea again this week for her forced draught trials.

The Great Eastern.—The sale by auction of the steamer *Great Eastern* concluded at New Ferry, Liverpool, on Saturday, November 24th. The auction occupied five days, and, generally speaking, fair prices were obtained. The total receipts were £58,000, and among the buyers were shipowners and merchants from all parts of the United Kingdom and abroad. The dismantling of the great vessel will commence in a few weeks' time, and it is expected that the work will occupy over 18 months. The vessel was purchased by the vendors, Messrs. Bath & Co., Liverpool, for £16,000.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from October 19th to November 15th, 1888.

15027 R. Wilson. Lenses employed as deck lights and in frames and fittings connected with such lenses.
15036 J. O'Kelly. Torpedoes; means and appliances for propelling and steering same.
15046 P. E. Rousseau. Pumps and hydraulic motors.
15065 R. Dixon. Flexible wire ropes, hawsers, and warps.
15072 T. Wood & J. Lowcock. Apparatus to check the erratic actions of pendulous governors, and to prevent same from communicating to the throttle valve.
15088 D. B. Morison. Supplying fresh feed-water to boilers.
15093 W. C. H. Chambers & J. Chambers. Partly collapsible boats.
15107 A. Sautter. Shipbuilding.
15108 A. Sautter. Using the motion of water as a motive power.
15207 W. T. Calderwood. Relieving ropes and chains from shocks and strains.
15229 J. Newton & D. A. Quiggin. Coiled tubular surfaces for condensing steam, &c.
15239 H. L. Lange. Intercepting valves for compound engines.
15250 W. H. Hall. Toy boats and ships.
15303 A. St. J. W. Wriford. Ships and vessels, and in the propulsion thereof.
15322 M. Immisch. Screw-propeller shaft coupling.
15334 T. F. Craddock. Anchors.
15342 D. B. Morison. Transhipping coal.
15391 R. B. Hughes. Paddle-wheel.
15456 W. Holt. Composition for packing glands of cylinders, &c.
15493 M. T. Neale & J. H. Smalpage. Signalling during foggy or hazy weather at sea.
15546 W. Reid. Reducing valve.
15564 J. Baynes, W. H. Doughty & H. T. Greaves. Paint for ships' bottoms.
15592 J. Cran. Steering gear.
15634 A. F. E. Grant. Dredger.
15774 A. Legé. Torpedoes.
15777 A. Schauschieff & M. J. Paul. Facilitating the coaling of vessels.
15822 W. Briggs & A. S. Fox. Engine packings.
15851 C. F. Gee. Steering of seagoing and other vessels
15923 C. L. G. Brumlen. Wind-motor for propelling ships.
15924 C. Suhrland & G. W. Mühlke. Propelling steamboats.
15971 J. Danby. Paint for protecting iron and steel ships.
15985 G. W. Atkins. Mariners' compasses.
15992 A. F. Windel. Lowering ships' boats.
16015 A. G. Mumford & A. Anthony. Steam engine and pumps.
16024 C. Chambers & G. Quarrie. Ventilating ships.
16029 J. Caldwell. Steam steering gear.
16091 H. C. Digman & J. B. Archer. Propelling steam vessels when main engines are disabled.
16095 Bosshardt (E. C. Sonnet & L. Leredde). Indicating speed of ships.
16105 J. H. S. Bradley. Propelling torpedoes and submarine boats.
16111 J. Fairlie. Side ports of sailing vessels and well-deck steamers.
16199 H. Lea. Ships' berths.
16229 M. Deis. Water-leveller for steam boilers.
16299 R. McKinnell. Steel plates for vessels.
16303 G. Thomson. Direct-acting duplex engines.
16350 S. Abraham. Cleaning boiler tubes.
16367 A. Bainbridge. Tube-scrapers.
16384 S. A. Johnson. Elastic packing for piston rods.
16385 Boult (E. Engels). Protection of gauge-glasses.
16401 H. Grafton. Grab buckets or diggers for dredging.
16403 H. Grafton. Grab buckets or diggers for dredging.
16434 E. A. Slade. Metallic packing for glands.
16438 H. Wilson. Electric register for taking speed of ships.
16449 Thompson (J. Rothchild). Governor for pressure engine.
16468 O. Phalp. Skylights and ventilators, applicable also to compass binnacles for use on board ship.
16518 R. Baird. Lubricators.
16557 C. J. & A. W. Galloway. Purifying feed-water for boilers.
16586 C. Womack. Smoke-consumer.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1 C, denotes First Class; 2 C, Second Class.

October 20th, 1888.

Adam, Jno. N.. 2C Liverpool
Anderson, J. W. 2C Glasgow
Bond, John Wm. 2C S. Shields
Cowie, Wm..... 1C N. Shields
Cullen, James .. 2C Glasgow
Davison, George 1C W. H'pool
Edmonson, Albert 1C Liverpool
Emmerson, R. H. 2C W. H'pool
Fleetham, Robt. 2C ,,
Foggs, Geo. T.. 2C Liverpool
Forbes, Chas. W. 2C ,,
Gill, Peter..... 1C W. H'pool
Gray, Adam.... 2C N. Shields
Hall, David Thos. 2 C South'pton
Jenkinson, Tho. 1C Liverpool
Jones, W..... 1C Cardiff
Kennedy, Wm... 2C Aberdeen
Kermode, John J. 1C Liverpool
Kirkpatrick, W. W. G. 1C Glas'.
Landale, David.. 1C ,,
Lewis, Andrew... 1C Cardiff
Liles, Geo. ..... 1C London
Liston, Andrew G. 1C ,,
Marriott, R. Lee 1C Cardiff
Martin, Daniel... 1C ,,
McDonald, James 2C Aberdeen
Midgley, Francis S. 1C Hull
Neill, Thos. ..... 1C Glasgow
Noble, John ..... 2C ,,
Parkinson, Fred. 2C W. H'pool
Paterson, W. A. 2C Aberdeen
Powell, Evan .. 1C Cardiff
Prothero, Lewis S. 2C ,,
Sharp, Albert E. 2C N. Shields
Sharp, Wm. .... 1C W. H'pool
Smith, Daniel B.. 1C Glasgow
Smith, John W. 1C London
Sydney, Chas. A. 1C ,,
Thomas, George... 1C Cardiff
Trowell, W. John 1C N. Shields
Volum, Alex. P. 2C Aberdeen
Wilson, John G. 2C ,,
Young, Robert .. 1C Hull

October 27th, 1888.

Brand, Edw. C. 2C London
Christie James N. 2C N. Shields
Dalgarno, G. B. 1C Sunderl'd
Davis, Wm. Edw. 2C London
Garbutt, Fred W. 2C Sunderl.d
Gibbison, Thos... 1C N. Shields
Hewitt, John Jas. 2C ,,
Hill, John..... 2C London
Horan, Henry .. 1C Sunderl'd
Horsfall, Robt. M. 2C Liverpool
Lawther, John R. 2C N. Shields
Nicholson, G. A. 1C Sunderl'd
Nicol, Wm..... 1C ,,
Pearce, Richard.. 2C Liverpool
Peters, Owen.... 2C ,,
Reeves, Wm. R.. 2C London
Roberts, Moses J. 2C Liverpool
Taylor, Timothy 2C Sunderl'd
Thomson, George 2C ,,
Young, Patrick A. 2C ,,

November 3rd, 1888.

Adams, Thomas.. 1C Glasgow
Barclay, Robert.. 1C ,,
Brodmeier, W. A. A. 2C London
Cunningham, R. 1C Glasgow
Fleming, Robert 1C Liverpool
Foyer, Alex. R. 1C ,,
Gardner, Thos. T. 2C N. Shields
George, John.... 2C Cardiff
Gregg, Wm. L... 2C Glasgow
Martin, John..... 2C ,,
McGlymont, Wm. 1C Liverpool
Morgan, Lewis L. 1C Cardiff
Morrison, Wm... 2C Glasgow
Mounsey, E. H. 1C Liverpool
Perkins, Christian H. 1C Glas'.
Rodger, M. G. .. 2C Glasgow
Ryan, John .... 2C Cardiff
Sharp, John .... 2C S. Shields
Sullivan, F. P. .. 2C Liverpool
Thoms, J. K..... 2C Glasgow
Walker, Frank.. 2C Liverpool
Whettingsteel, Jas. 2C ,,
Weeks, G. H. .. 1C ,,
Wilkins, Edmd. J. 2C Cardiff
Wilson, A. E.... 1C Liverpool
Wilkinson, W. H. 2C London
Williamson, J... 1C ,,
Wilson, Robt. .. 1C N. Shields
Wilson, Robt. .. 1C Glasgow

November 10th, 1888.

Adamson, Duncan 2C Leith
Borthwick, John 2C ,,
Buck, Henry T. 1C London
Colpitts, Thos... 2C ,,
Dennant, W. Jas. 2C ,,
Dixon, James .. 1C N. Shields
Kirkaldy, W. H. 2C Leith
Macdougall, D.. 1C London
Mackay, Roderick 1C Leith
Main, Wm. P... 2C ,,
McGregor, John 2C Greenock
McKeand, Allan 1C ,,
Mitchell, David 1C London
Muir, James.... 2C Leith
Pritchard, R. J. 2C Liverpool
Taylor, Joseph F. 1C ,,
Whincop, W. N. 2C S. Shields
Young, George B. 1C Leith

November 17th, 1888.

Anderson, T. W. 2C N. Shields
Bell, W. H..... 2C Liverpool
Bishop, James.. 1C Cardiff
Bolton, E. J... 2C N. Shields
Brundrit, J..... 2C Liverpool
Careful, T..... 1C ,,
Davies, T. .... 2C Cardiff
Hamlet, G. H. 2C ,,
Jones, M..... 2C Liverpool
Jones, R. O..... 1C ,,
Mackenzie, M. A. 2C Hull
Mann, J. B..... 2C Liverpool
Matthew, C..... 1C ,,
McNaughton, J. 2C ,,
Melburn, A..... 1C N. Shields
Midgeley, F. W. 1C Hull
Moore, Fredk. .. 2C Cardiff
Nicholson, A.. .. 2C ,,
Paterson, W. .. 1C London
Parkinson, H. S. 1C ,,
Rainey, Francis E. 2C ,,
Richardson. S... 2C N. Shields
Robinson, J. W. 1C ,,
Russel, A. .... 1C Liverpool
Scott, Joseph ... 1C N. Shields
Seymour, W. .. 2C Cardiff
Spence, T. R. .. 2C London
Trounson, S. .. 2C Hull
Vienna, G. W... 2C Liverpool
Warriner, H. .. 2C ,,
Wright, J. W... 2C ,,
Yates, E. P..... 2C Liverpool

The Marine Engineer.

LONDON, JANUARY 1, 1889.

THE question of the best armour for battle ships again seems to be as unsettled as ever. This, no doubt, follows from the great variety of missiles to which armour may be exposed under the rapid march of modern invention. It may be assumed that steel-faced wrought iron armour has, for the present, been accepted as the most perfected form to offer the hardest resistance to the entry of projectiles, whilst maintaining ample toughness to prevent serious fracture under the impact of a projectile. Trials are now going on at Portsmouth on board the *Nettle*, with a view to determine this question, and, from the large number of invitations to steel makers, it appears to be the chief object of this trial to compare the relative resistance of steel-faced armour to solid steel armour. As steel armour may be supplied at any required degree of softness, the question of steel armour would rather become the question of the relative hardness or softness of the said steel, even were a homogeneous metal ultimately decided on as being the best. It is also evident that the choice may ultimately lay between dead hard metal to resist penetration, or more or less mild steel to retain toughness. Were it merely a question, with regard to projectiles, of the impact of a certain mass of metal at a certain speed, a practicable result could no doubt soon be arrived at, but the change in construction of projectiles, especially in the form of chilled steel shells carrying a deadly explosive charge of the newest and most violent explosives, seems likely to modify the whole question on the grounds as to whether it might not be better to ensure, by extreme hardness, absolute prevention of the entry of projectiles within the ship, and risk the fracture of the plates. There is no doubt that the modern chilled steel shell has now reached perfection of manufacture to penetrate any armour of combined wrought iron and steel, or of homogeneous more or less mild steel. To permit penetration through such armour for the sake of preventing the entire fracture of the plate is now a serious alternative, since the explosion of such a projectile in board, after the side has been penetrated, is an awful catastrophe to contemplate. The bolting or riveting might be looked upon as some slight protection for the plate to hold together, and it would seem to be better to risk a completely shattered plate with the repulsion of these fearful explosive modern shells, than to risk the entry of one in board. That it might be possible to produce a steel armour sufficiently hard to actually ensure the repulsion of the projectile is well within known means; as, for instance, Gruson's chilled armour would certainly repel any chilled shell until after the said armour had been broken up. Were attention directed to this, it probably would mean again a fresh departure. We are somewhat surprised, also, to notice that no attention has apparently been paid to the possibility of constructing a sufficiently elastic external steel or iron plating suitable for offering a sufficient elastic recoil to enormously aid the absorption of the energy of the projectile without penetration. While the plating is applied direct to the hull of the vessel, constructed in the most solid and rigid form as at present generally designed, the armour is placed in the least possible condition of efficiency to repel projectiles without fracture or penetration. Now a good deal has been said in favour of the employment of elastic substances, such as packed cotton wool, india rubber, and woodite, for the elastic absorption of the energy of projectiles without fracture or penetration, and this is no doubt a perfectly correct theory, but the main question as to suitability of material has not yet been practically or universally solved. It is strange that this principle has not been taken up to a greater extent in the form of an elastic support of the already employed or modified metal armour. A further idea, which was the outcome of the extraordinary success of the *Merrimac* when first introduced, is to employ the surface armour arranged so as to present only an oblique surface to impact from the water line upwards, and thus to prevent projectiles having the immense advantage of direct impact for penetration.

SOME excitement is being created amongst the shipowners of the North-East Coast as to the question of railways extending their enterprise in any degree to the ownership and running of general purpose steamships. This excitement is chiefly due to a proposal of the Manchester, Sheffield, and Lincolnshire Railway to obtain the passing of a bill to enable them to run lines of steamships from Grimsby to a large number of ports in Germany, Denmark, Sweden and Norway especially. The objection of the steamship owners to such a course and such an extension of the powers and intentions of the railway companies, is, to our mind, only natural. The railways, for the sake of competition, may subsidise such lines to enable them to exert unfair competition until the small shipowners are crushed out of the market. They look upon this fresh proposal as foreshadowing a great extension of freight carrying as compared with the present lines of fast passenger steamers already owned by railway companies for the transfer of passengers and

goods in direct main routes to the Continent. It is well known that there is no lack of steamship carrying power at present, but rather the reverse, and that in so far as such trade is remunerative, vessels can always be found in the outside market to carry the traffic at a very small profit. Should the railways see fit to carry this traffic at lower rates than will pay expenses and a margin of profit, it will but serve the purpose to crush other commercial enterprise which is unsupported by subsidies or the enormous capital of the railway companies, without at the same time any benefit or remuneration to the shareholders of the railway companies themselves. We recommend this question to the said shareholders of railway companies so that they be not led blindfold into a large expenditure of capital which might be unjust to private interests and at the same time unremunerative to themselves.

CARDIFF has again brought herself into notice with shipbuilders and marine engineers generally, for the facility she has just offered in the Roath Dock to a prompt repair to the steamship *Monkseaton*, of Newcastle. The *Monkseaton* is a vessel of 2,900 gross tonnage, and she lost three blades of her propeller when on a voyage from Liverpool to New York with a general cargo. On putting into Cardiff to refit, she was placed upon the pontoon dock belonging to the Wallsend Pontoon Company, with 2,000 tons of cargo on board. Her stern was by this means raised out of the water sufficiently high to allow the broken propeller to be unshipped and a new one fitted in place. The operation of raising the stern of the vessel and the changing of the propellers only occupied twenty-three hours, and thus the saving of time and money in the rapid and prompt method of carrying out the repairs, and without the expense of having to discharge her cargo, must be very considerable, and no doubt will be regarded as a great advantage attaching to the Bute Docks in Cardiff as a repairing station. A similar operation was performed upon the steamer *Shamrock*, which had collided with the steamer *Clare*, in the Cardiff roads, at the end of last month, and the damage, which extended a considerable distance under water, was readily repaired without touching the cargo. Cardiff being on such a handy part of the coast, we have no doubt that the shipping world at large will take notice of such a handy repairing port, and be glad to avail themselves of it.

MESSRS. R. NAPIER & SONS, of Glasgow, have contributed two splendid ships for our navy, the *Australia* and the *Galatea*. They belong to the class of swift and powerfully armed belted cruisers, especially designed for the protection of our national commerce. Their displacement is about 5,000 tons when in normal fighting condition. They are protected by a belt for two-thirds of the length, consisting of steel-faced compound armour, 10 in. thick. All the machinery of importance, including the steering gear, air compressors and electrical plant, is placed under a protective deck of two to three inch steel. The engine and boiler-rooms are protected also by coal bunkers at the sides, and the under-water portion of the hull is divided into minute subdivisions of watertight cells. The armament consists of two long-range 22-ton breech-loading guns and central pivot mountings on the upper deck fore and aft respectively. The engines were originally specified by the Admiralty to be of the ordinary compound type for 7,500 H.P., but, from their previous experience, Messrs. Napier are able to show that, by substituting triple-expansion engines for the compounded engines specified, they could guarantee an increase of 1,000 H.P. and almost a knot better speed, without adding to the total weight of the machinery and coal. As this would add enormously to the value of the vessel as a fighting machine, for its specific purpose, the suggestion was adopted by the Admiralty, and was carried out in other ships of the class. In the case of the *Galatea*, on its trial test, the collective H.P. with forced draught was 9,204, which was 700 H.P. above Messrs. Napier's statement, and 1,700 H.P. above what was originally proposed by the Admiralty. This result was attained with a consumption of not more than 1·97 lb. of coal per I.H.P. per hour, the steam being supplied in such abundance that the boilers maintained a constant blow-off.

ENGINEER OFFICERS OF THE ROYAL NAVY, RANK AND PAY, AND REQUIRED IMPROVEMENT OF SUCH.

THE indifferent manner in which the significant grievances of the Engineers of the Royal Navy, as regards rank and pay have been treated by the authorities who were and are able to minimise if not get rid of them, is a matter of great injustice both to these meritable officers as a class and also to the naval service generally. Their interests in these respects have, we regret to state, been pointed out very jejunely by what are known as the service newspapers, although writers of articles concerning them therein have frequently possessed adequate information to reasonably point out their complaints and advocate the cessation or material diminution of such.

An excellent pamphlet has just been prepared in which the grievances referred to, and how they should be remedied are very fully mentioned. The substance of the leading statements therein and a few running comments on them we will now notify.

It appears that in 1862, on the general adoption in the British Navy of steam propulsion, and when ironclads were brought into use, the duties of the engineer officers were practically limited to the efficient maintenance of the propelling machinery of the ships and keeping watch in the engine rooms or stokeholds when the ships were under steam. Consequent on the progress, however, of naval engineering, and the application of machinery for

many other purposes than propelling ships, the number and importance of the responsibilities of these officers have immensely increased during the last twenty-six years. Yet the number of engineer officers of all grades has been reduced to 670, which is one-half the number thought necessary for the navy in 1862. This reduction is owing to the fact that a new class, called engine-room artificers, have been employed in the Navy at much lower rates of pay than those given to Engineer Officers, to perform the manual work or those of a peculiar mechanical nature, relating to the repair and refit of the machinery.

Although the numbers of the Engineer Officers have been reduced by one-half since 1862 the engine-room staff over which they exercise supervision has increased more than 60 per cent. during the last ten years, and it is probable that this percentage will soon be greater.

Again, though at the present time these officers are, as the *Army and Navy Gazette* states, by birth and breeding certainly the social equals of any of the other civil branches of the service, they are still, as these officers properly say, "far behind every other class of commissioned officers in the matter of pay and also in rank (with the exception of accountant officers, whose rank corresponds with that of Engineer Officers)." The reasons for this injustice are well pointed out. As early as nineteen years of age the executive officer can attain lieutenants' rank if he is successful in his examinations, and at any time subsequently; and the medical officer at from twenty-two to twenty-seven years of age on entry into the navy. On the other hand, the engineer officer does not reach sub-lieutenants' rank until he has finished his period of service, firstly as an assistant engineer and afterwards for six years as an engineer, by which time he will be thirty-two or thirty-three years of age. On promotion to the rank of chief engineer, Engineer Officers rank "with, but after, lieutenants of eight years' seniority."

As regards pay, except the very junior grades of sub-lieutenants and assistant paymasters, the Engineer Officers are, during the whole of their service, paid far less than the officers of a corresponding age and service; "and while in these other branches it is possible for the officers to attain their maximum rate of pay of 33s. per day at a fairly early age, the engineer officers can only attain their maximum rate of 22s. per day (11s. per day less than the medical and accountant officers) at an age when they are just on the point of retiring from the service. In fact, at the present time there are not a half-dozen fleet engineers in receipt of the maximum rate of 22s. per day, all the remaining fleet engineers receiving only 18s. per day or less."

Intense dissatisfaction exists among engineer officers on account of their past and exceptional treatment as regards pay and rank, and such feeling will continue until their grievances are reasonably settled. They submit that the relative rank of "with, but after," which is merely a bogus rank, may in all cases be abolished, and that they may be granted pay and relative rank as follows:—

Title.	Full pay per day.	Relative rank.
	s. d.	
Assistant engineer on entry	7 6	Sub-Lieutenant
" " after 1 year's confirmed time	9 0	"
Engineer on promotion	10 0	Lieutenant
" after 4 years' service...	12 0	"
" after 8 years' service...	14 0	"

That the present title of "chief engineer" as indicating a definite rank of engineer officer, be abolished, as being unnecessary, misleading, and confusing, now that the titles of "staff engineer" and "fleet engineer" are introduced, and also because by recent additions to the regulations it is directed that the term "chief engineer" shall be used in a generic sense, and shall mean the officer in charge of the machinery and boiler, whatever his rank may be.

Title.	Full pay per day.	Relative rank.
	s. d.	
Staff engineers on promotion	16 0	Lieutenant of 8 years.
" after 2 years' service	18 0	" "
" after 4 years' service	21 0	" "
" after 6 years' service	24 0	" "
Fleet engineers after 8 years' senior service ...	27 0	Commander.
" after 10 years' senior service	30 0	"
" after 12 years' senior service	33 0	"

That the titles of "inspector" and "chief inspector of machinery," be altered to "deputy inspector" and "inspector of naval engineering" respectively, and that their full pay per day and relative rank be:—

Title.	Full pay per day.	Relative rank.
	s. d.	
Deputy inspector of naval engineering ...	40 0	Captain according to date of first commission as deputy inspector of naval engineering.
Inspector of naval engineering	50 0	

As an engineer officer receives high instruction and training in a naval dockyard as engineer student, and is required to pass a difficult qualifying examination for entry into H.M. naval service as assistant engineer, which will enable the successful competitor to be "fully competent to undertake all the duties he may have to perform in that rank immediately he enters the Navy," there is not sufficient reason for the five years' confirmed service which an assistant engineer is required to serve before being elegible for promotion to the rank of engineer; the engineer officers rightly think that the junior officers should be elegible for promotion as an engineer after three years' confirmed service as assistant engineer.

The Engineer-in-Chief who is a naval engineer officer (an inspector of machinery R.N.) merely ranks with a captain under three years' seniority, and is not placed even as senior officer of his branch. He is only paid a salary of £1,000 a year, rising to £1,200 per annum, after five years' service. At the present time machinery is under construction for about 50 ships of 193,000 I.H.P., costing £1,332,000, for which he is personally responsible. The Engineer Officers "consider the want of suitable position and emolument of their head as a slur and reflection, not only upon themselves but upon the whole engineering profession generally, and it appears to them a matter of painful regret that the engineering head of the first steam navy in the world has not been granted equal rank with the heads of the other civil departments of the Navy, nor the emoluments to which his professional position and his capabilities appear to them to entitle him." This statement is materially strengthened by one from Mr. Forwood, M.P., Parliamentary Secretary to the Admiralty, in his evidence before the Royal Commission on Civil establishments in 1887, when he said that "We pay too low for our experts—for our professional assistants . . . . We are giving £1,200 a year to our Engineer-in-Chief, who has charge of the biggest steam fleet in the world. You are paying him £1,200 a year, while a first-class engine-works—we will say Elder's at Glasgow—would not hesitate to pay £4,000 or £5,000 a year to get a competent man." The Engineer officers therefore wish that the Engineer-in-Chief "may be placed at the head of, and senior to, all Naval Engineer Officers as 'Director-General of Naval Engineering,' that he have relative naval rank with a Rear-Admiral the same as that of Inspector-General of Hospitals and Fleets, and that his salary be increased to at least £2,000 per annum, the same as that paid to the Director of Naval Construction."

With respect to half-pay the following rates are proposed instead of those at present awarded to Engineer Officers:—

Title.	Half-pay per day.
	s. d.
Assistant Engineers	4 6
Engineers under 4 years' service	6 0
" over 4 " "	6 6

That junior time as at present arranged be allowed to reckon towards half-pay of the senior grades (*i.e.*, Staff and Fleet Engineers) at the following rates per day:—

Title.	Half-pay per day.
	s. d.
Staff and Fleet Engineers, under 5 years' service	8 0
" " " over 5 " "	9 0
" " " " 8 " "	10 0
" " " " 11 " "	10 6
" " " " 14 " "	12 0
" " " " 17 " "	14 0
" " " " 20 " "	16 0
" " " " 25 " "	18 0
Deputy Inspector of Naval Engineering	25 0
Inspector of Naval Engineering	30 0

No improvement is suggested concerning arrangements for retirement as the Engineer Officers think on the whole these are satisfactory.

Concerning extra pay these officers state that the senior engineer of all ships in commission be allowed a minimum of 1s. per day beyond their ordinary pay, and that the following sliding scale of extra pay be adopted for Senior Engineers:—

If senior engineer of ships in commission of over 3,000 I.H.P., 1s. 6d. per day.

If senior engineer of ships in commission of over 6,000 I.H.P., 2s. per day.

If senior engineer of ships in commission of over 9,000 I.H.P., 2s. 6d. per day.

In the case they present in support of the improvement of their rank and pay, it is well stated that "in placing the foregoing proposals with regard to the pay and relative rank of the various grades of their branch of the service for the consideration of the Admiralty, the Engineer Officers beg respectfully to point out that the concession of their requests will be a measure not only of justice, but of wise economy; of justice, because they are surely entitled to as much consideration in these matters as are the officers in the other departments of the Navy, and of wise economy because the increased importance of the engineer branch and the responsibilities attached thereto demand a proportionate and just recognition, which can alone give perfect satisfaction and efficiency."

We have good reason to believe that the Engineer Officers have neither overstated their grievances nor asked for them to be remedied in an unjust manner. We trust that they will continue their efforts to attain their objects as speedily as possible, and that they will be conceded without reluctance in the near future.

BRISTOL CHANNEL PORTS.

I. CARDIFF.

WE know no port which has increased so rapidly as Cardiff; its equal may be found in that land of big things, America, but its rapid rise is unequalled in this country. Its growing importance in the coal trade has not been noticed without jealousy by coal ports of older standing. The Tyne Commissioners, it will be remembered, some twelve months since contradicted, time after time, the announcement made by the Bute Dock authorities that their port headed the list for export of coal; but no heed was paid to the objection, nor indeed was there any need to do so, for Cardiff does undoubtedly occupy the proud position of premier coal port of the world. And its growth in this trade has been rapid; in 1877 its total export of coal amounted to 4,469,494 tons and in ten years this had increased to 6,858,299 tons. The total imports of 1877 amounted to 4,668,727 tons, the total exports of 1887 amounted to 6,858,299 tons. If we go back 40 years we find that the total coal exports amounted only to 510,722 tons.

As everybody knows Cardiff owes its importance as a port to the Bute family who first commenced dock construction there in 1830, when an Act was obtained for construction of the West Bute Dock. Previous to that time the coals of the district had been shipped at the sea pond of the Glamorganshire canal, a waterway completed in 1798. The Marquis of Bute, seeing only too plainly that his vast mineral estates in Glamorganshire could never be made the most of without better shipping facilities, constructed the first dock at a cost of £350,000. But even with the improved shipping facilities thus afforded the trade of the port did not increase as was expected. There was evidently something lacking, and that something was rightly considered to be an improved means of communication between the collieries and the docks. The result was a railway, the nucleus of the now celebrated Taff Vale, being constructed, and from its opening in 1841 Cardiff's unique leaps and bounds in the volume of its shipments commenced. The increasing trade called for more extensive dock accommodation, and accordingly the East Bute Dock was constructed. About the same time the Rhmyney Railway Company was formed and a line commenced to open up more extensively the coal fields of the Rhmyney Valley, the coals from which had, up to this time (1858), been transported by means of a tramway to Newport. Further accommodation was afforded in 1874 when the Roath Basin was opened. From this time nothing was done in the way of increasing the dock accommodation until about 1883, when the Cardiff coal shippers complained loudly that they could not carry on their trade properly without increased dock room, and finding, or fancying they found, the Bute authorities difficult to deal with, they sought for, and, after a hard fight in Committee, obtained the necessary Parliamentary powers for the construction of a dock at Barry Island. This dock is not yet completed, but the new Roath Dock, commenced at almost the same time by the Bute dock people, is already finished and at work. This Roath Dock is the finest owned by the Bute Dock Company. It has a water area of thirty-three acres, and the length of its quays is no less than 7,520 lineal feet. It possesses the most important coal shipping facilities, and its capacity is said to be enough to accommodate an additional trade of no less than 5,000,000 tons per annum.

The Barry Dock, which we mentioned above, will, it is expected, be opened in the early part of next year, and great things are expected of it. Its area is seventy-three acres, and it will be a coal dock almost pure and simple. In coals it should command a very large trade, for connected with it there are some of the largest coal shippers in Wales. There are some people who fear it will play sad havoc with the trade of the Bute docks and the Penarth Dock of the Taff Vale Company, but there need be little fear of this. The Welsh coal trade is so elastic that there will be room for all comers.

In addition to the dock accommodation named above, there is the Penarth Dock, lying under the shelter of Penarth Head, and which was constructed by the Penarth Dock Company in 1857. The area of this dock is three and a-half acres, and it is worked by the Taff Vale Railway Company, who lease it for 999 years from the Dock Company. It will thus be seen that there are at Cardiff ample facilities for carrying on a large coal trade, although the freighters vowed and protested in 1883 that they, metaphorically speaking, had no room to stir.

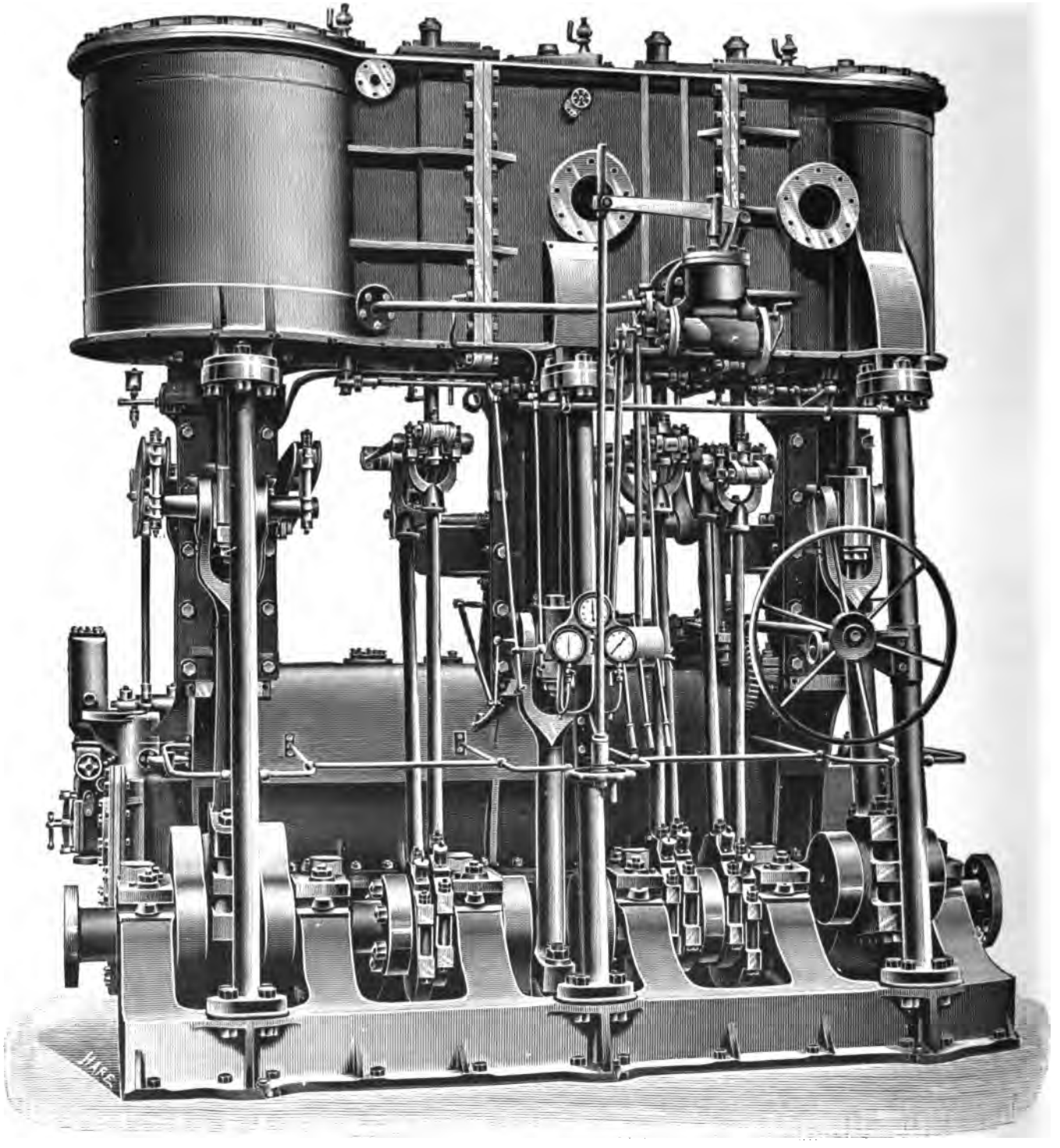
In addition to coal shipping facilities, the Bute Docks are able to cope with a very much larger import trade than they have at present. The imports for 1887 amounted to 1,139,984, and of this the greater part was made up of iron ore, 463,461 tons, and pitwood 274,150 tons. Grain, of course, came third, with 131,271 tons, and it is in this trade especially where there is room, we should say, for a very large increase. There appears to be no reason in the world why the food stuffs consumed in the great industrial districts of Wales should be nearly all imported *via* Bristol as is at present the case. Endeavours are now being made, however, to foster an import trade, and before very long we shall find Cardiff occupying almost as important a position in imports as in exports. In the importation of hewn timber, we should add, the port already occupies an important position.

So far as railway accommodation is concerned, the port is well served. In communication with the Bute Docks there are, in addition to the local railways, the London and North Western, the Midland, and Great Western Railways. It will thus be seen that the Dock Company speak words of truth when they say that the port is well situated for doing an import trade.

In considering the port of Cardiff, we must not lose sight of the fact that, although the Bute family have done much for the place, local enterprise has also done much. The Glamorganshire Canal, for example, was the outcome of the endeavours of local people who found that the old-fashioned mode of transporting coal to Cardiff from the hills—on mule back—was too slow. Then, again, the world-famed Dowlais Iron and Steel Works are the outcome of private enterprise, and it is the hard work and perseverance of such people as David Davies, of the celebrated Ocean Collieries, who have found that coal which has made the name of Cardiff famous throughout the world. The Marquis of Bute owns some collieries himself, but his output is small compared with those of the Crawshays, D. Davies & Co., D. Davis & Sons, the Dowlais Co., and others.

In industries apart from shipping, it must be admitted that Cardiff has been somewhat backward. Nor is this at all unnatural. As Middlesbro' is Ironopolis, so Cardiff is Coalopolis; and the two places for years attended only to their chief industry. As Middlesbro' has changed, however, so Cardiff is changing. The Dowlais Iron Company are putting down blast furnaces on a site to the east of the East Dock, in close proximity to the works of the Tharsis Company, and no doubt the example thus set will be speedily followed. The tendency of our big manufacturers is to move nearer to the seaboard, and the advantages possessed by Cardiff will no doubt ere long attract inland manufacturers. It is true that shipbuilding has been tried, but the shipping crisis put an end, for a time, to this industry. We understand, however, that the Bute Shipbuilding, Dry Dock and Engineering Co., to whom the shipyard belongs, are about re-starting shipbuilding operations.

Of course in a place doing such an enormous shipping trade as Cardiff, ship repairing is a prominent industry, and the port possesses some eight dry docks and a couple of patent slips, as well as



TRIPLE-EXPANSION ENGINES OF S.S. "DUKE OF CORNWALL" AND S.S. "DUCHESS OF CORNWALL."

CONSTRUCTED BY THE CENTRAL MARINE ENGINEERING COMPANY, WEST HARTLEPOOL.

numerous repairing shops. With these we shall deal at a later date when considering the "Ship repairing facilities of the Bristol Channel."

All of our readers have no doubt heard much of the opposition promised Cardiff at the hands of the company owning the new Barry Dock, and in concluding the present brief sketch of Cardiff we cannot do better than pay fuller attention than we have hitherto done to this competition. There can be no denying the fact that the new dock will take from Cardiff some of the coal trade already done there. There are connected with the new dock some of the leading coal shippers, and it goes without the saying that they will divert every ounce of traffic they can from the Bute Docks. But considering the enormous and increasing volume of the Welsh coal trade, and that foreign buyers want *Cardiff* coals, not Welsh, there is no reason to believe with some pessimists that Cardiff is doomed. On the contrary, we believe that no better thing ever happened for Cardiff than that agitation which resulted in the construction of the Barry Dock. The possibility of losing a portion of their coal trade will spur the Bute Dock authorities on to use every possible endeavour to attract other trades. As we have already said, there is ample accommodation for doing a large import trade; there is, in addition, every facility for establishing a large general export trade. Cardiff is the natural port of the Midlands, and sooner or later this will tell. Barry may take from Cardiff some of her coal trade, but she can never take from the older docks their geographical position, or so admirably fit them for the position of doing a large and important general trade. Ten years hence Cardiff will not be known as a coal port pure and simple, it will be known as a second Liverpool, doing trade with all parts of the globe, and in every description of merchandise.

TRIPLE-EXPANSION ENGINES OF S.S. "DUKE OF CORNWALL" AND S.S. "DUCHESS OF CORNWALL."

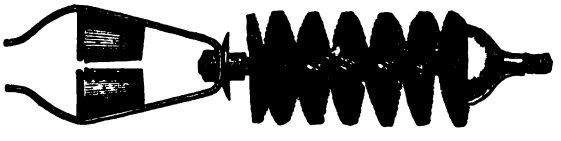
WE publish this month a whole page supplement, illustrating some very successful triple-expansion engines made by the Central Marine Engineering Company, of West Hartlepool, viz.: those of the *Duke of Cornwall* and *Duchess of Cornwall*. These vessels are built by Messrs. Wm. Gray & Co., of West Hartlepool, to the order of Mr. Richard B. Chellew, of Truro, and are cargo steamers of 2,600 tons deadweight carrying capacity. The engines we illustrate are of the size designated 700 I.H.P. by the makers, and have cylinders 19 in., 30½ in., and 51 in. in diameter, with a stroke of 36 in. It will be seen, on referring to our engraving, that the high-pressure cylinder is placed between the other two, and the three are strongly bolted together from top to bottom, so as to make one solid and compact structure. In adopting the system of placing the high-pressure cylinder in the middle, the makers of these engines have a distinct economic object in view, and from the experience they have now had of a large number of engines built on this plan, are convinced the economy they looked for has been secured. As the arrangements in connection with the cylinders form the principal point of interest in these engines, we purpose to describe them a little more in detail. It appears to be a fact, that the comparative loss due to radiation from two surfaces at different temperatures is not proportionate to the temperature, but that the radiation ratio is enormously greater than the ratio between the temperatures. Hence it follows that the most economical arrangement of three cylinders at different temperatures in point of radiation must be that adopted in these engines, viz.: the hottest cylinder in the middle, and the three so enclosed together that the outer surfaces of the whole structure, where coming in contact with the atmosphere, are constantly at a temperature far lower than the temperature of the first cylinder itself, and as nearly as possible that of the atmosphere. This system not only economises the use of steam in the engine, but tends very greatly towards keeping the engine-room cool, so that the attendants are in a fit state to prosecute their daily duties healthfully and comfortably. All the valve chests are placed between the cylinders, and the high-pressure cylinder has a separately cast hard liner, the space between it and the inner wall of the cylinder casting forming a high-pressure jacket, supplied direct from the boiler. This jacket fulfils a double function. It is capable of giving off heat usefully both from its inner and its outer surfaces. Its inner surface performs the function of preventing radiation and reducing condensation within the high-pressure cylinder itself, and its outer surface tends greatly to reduce condensation in the receivers or lower steam chests by being enclosed within them. It seems certain that whatever heat is given off by the jacket under such circumstances must be wholly recovered for useful work in the working steam of the engine. The outer surfaces of the cylinders as a whole will thus be seen to be always at low temperatures, the small end (consisting of about one-third of the surface) at a temperature at or below that of the working steam of the mean-pressure engine, and the larger end (consisting of about two-thirds of the surface) at a temperature at or below that of the working steam of the low-pressure engine. To further prevent radiation, the whole cylinders are clothed to a depth of 2½ inches with fossil meal non-conducting composition, which is believed to be the most efficient non-conductor in existence, the whole being enclosed in a sheet steel casing similar to locomotive work.

The crank shaft of these engines is made in three sections exactly like each other, bolted together by flange couplings, the face of each coupling being the same distance from the centre of the crank pin so that the shaft as a whole or any individual section of it may either be turned round end for end, or any section may be used interchangeably with either of the other two. Each section of the shaft is made on the built principle, that is to say the body pieces, pins and webs are shrunk together, there being fifteen pieces in all in the shaft. These crank shafts are of Siemen's-Martin ingot steel, are made by one of the best steel makers, and are guaranteed to be equal to any make of forged steel crank shafts that can be brought into competition with them in the testing machine. The piston rods are also of similar forged ingot steel. The main bearings and crank pin bearings are all exceptionally long, and their bearing surfaces are composed entirely of a high class quality of white metal run in very stout cast-iron blocks. It is the opinion of those in authority at the Central Engine Works that a journal should not be run on a bearing composed of two different metals, or of metals of different degrees of hardness; and on this opinion is based their practice of putting the white metal into cast-iron blocks and allowing the journal nowhere to touch anything else but the white metal which covers the whole surface of the bearing. This practice has resulted in the highest degree satisfactorily, for they have fitted the engines of nearly forty steamers in this way, some of which have been at sea over three years, and up to the present not a single trouble either great or small has resulted from it, and in no case are the bearings known

to have worn more than the thickness of one thin liner in twelve months' work. The obvious result is that flaws and breakages are scarcely likely ever to arise in these shafts, and up to the present not a single crank shaft so fitted by this firm is known to have a mark in it of any kind. Another excellent feature in these engines, and one that further tends to preserve the crank shaft from damage is the design of the bedplate and its attachments to the ship. A glance at our engraving will show that the bedplate is level on its under surface, and that it is secured to the ship, not only at the front and back, but also immediately beneath the crank shaft, so that the reciprocating stresses are solidly borne without spring in the bedplate, and so avoiding the opening and closing of the jaws of the crank webs, which is probably one of the causes of failures of crank shafts.

These engines are fitted with steam reversing gear very snugly arranged on the top of the condenser, and all the hand gear is led to the centre column, so that one man can work the engines into and out of port with the greatest ease and comfort. When the *Duke of Cornwall* was completed, the opportunity arose of trying her speed at sea, the vessel having on board 2,613 tons deadweight, with a mean draught of 18 ft. 8½ in., when it was found that at 65 revolutions per minute the vessel averaged rather over 9 knots per hour, and when fully let out the engines made 74 revolutions per minute, the vessel going almost exactly 10 knots per hour. The steam is supplied by two steel boilers 11 ft. 6 in. diameter by 10 ft. long, with 150 lb. boiler pressure. They are fitted with Brown's patent ribbed furnaces. The trial, which lasted some hours, proved the boilers to be capable of maintaining the full steam pressure with the engines going at their maximum speed. This vessel has now completed several most successful voyages to the Mediterranean, and her consumption averages nine tons per day. The engines run without the slightest hitch or trouble of any kind, and all working parts have been proved by overhaul to be in first-class order. So successful have these engines been that the owners have now ordered a third steamer, to be exactly similar, and although the first steamer fitted with engines from these patterns has not yet been seven months at sea, the builders have altogether received orders for no less than fourteen sets to be made from the very same patterns, which is the best practical acknowledgment of their superior qualities.

GALES' PATENT TUBE BRUSH & SCRAPER COMBINED.



WE have recently had our attention called to a very novel and useful article for cleaning the tubes of marine and other boilers, and as our readers are well aware that to rapidly and effectively keep the tubes of boilers thoroughly cleansed from corrosion or deposit is a very important duty on board of steam vessels, we have therefore much pleasure in noticing and illustrating the invention of Mr. W. H. Gales, possessing as it does the two-fold advantage of enabling the tubes of multitubular boilers being effectively acted upon and cleaned uniformly at one and the same operation, instead of by the ordinary method of first scraping and then brushing the tubes, as now in use, and without the intervention of any internal springs, and it therefore appears superior to other separate class articles.

It will be seen by the above engraving that the Scraper is formed with an elongated curved guard or arms on the fore or leading part of the Scrapers, curved inwards and outwards to guide or enable the Scraper to freely enter the tubes; and as in practice it frequently occurs with ordinary brushes and scrapers, there is a difficulty to secure the "recovery" or easy return, if the length of the tube is over-reached, and to obviate this a cup or dished washer is provided, which materially helps to keep the brush "well up" in position, and preventing it from "splaying," and must assist in their durability.

The Scraper is formed with a fore or leading cutting edge or lip around its circumference and in two segments, securely riveted around to the curved guard or frame, so as to freely and elastically expand and contract, and so give to any inequality in its passage through the tubes without "scoring" them, and enabling the refuse to freely pass through ready for the brush to immediately follow and act upon the same either in the forward or backward action.

Mr. W. H. Gales, therefore, claims by its use that a very material loss or reduction of heat in the furnace during the operation of cleaning the tubes is avoided by the great saving of time secured and perfection in results, and a consequent gain and uniformity of steam pressure secured by its effectiveness and rapidity of action in one operation of *cutting* and *brushing* the tubes; likewise a material saving in the coal consumption is effected; and he further informs us that the "Patent Tube Brush and Scraper Combined" is manufactured from the very best spring steel, specially tempered so that they are not affected by intense heat.

We learn that it is being largely adopted by most of the leading steamship companies, also railway companies, and other steam users, both here and abroad, for their multitubular boilers. Among a numerous list of testimonials before us we note that the chief engineer of the s.s. *Essex* (Messrs. Money Wigram & Co., Limited) states—"That it has given great satisfaction, and considered by him to be the best practical tool of its class, and that two of the Patent Combined Brush and Scrapers were solely employed in the out and home trip to Sydney and back, keeping 1,100 tubes in perfect condition." Likewise the chief engineer of the s.s. *Cambodia* expresses a similar opinion, and that "it thoroughly cleanses the tubes, and considers it a saving of at least 60 per cent. over any brush, and that they were used in sweeping both boilers on a passage out to Japan, and were still in use out there."

We therefore consider that they may be found worthy of a practical trial, and to all appearance are made in a very substantial manner, such as claimed by the inventor.

ENGINEER APPOINTMENTS.—Mr. John T. Corner, who has filled the office of first assistant to the chief engineer at Portsmouth Dockyard since December, 1882, has been appointed chief engineer in succession to Mr. Durston. Mr. Mayson gets a step in promotion, while Mr. Wishart, Admiralty overseer of machinery, becomes second assistant engineer at the yard.

HEALEY'S PATENT DUPLEX ROCKING FURNACE BARS.

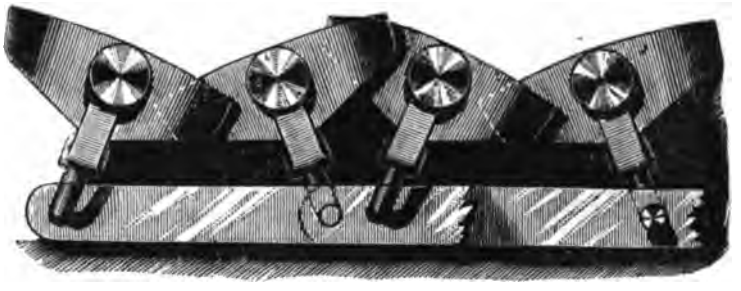
WE recently inspected, at the office of Messrs. Crompton & Compton, 19, Gracechurch Street, E.C., who are the London and South Coast representatives of the Municipal Appliances & Engineering Co., and makers of this speciality, a working model of the bars which we have pleasure in herewith illustrating.

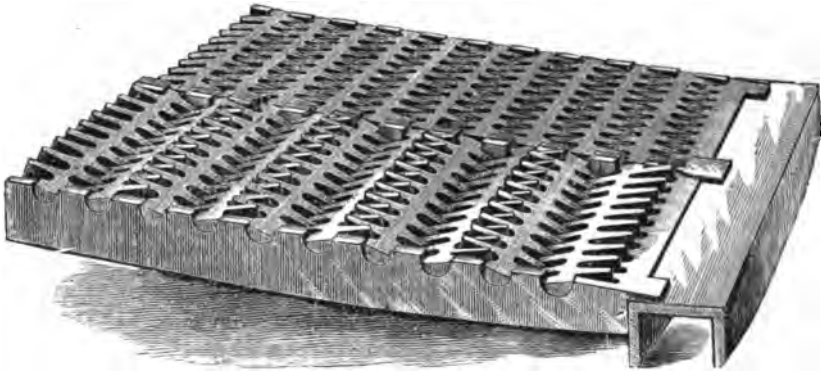
As will be seen from the illustrations, each bar is formed with a number of deep teeth on each side, so spaced and disposed that the teeth of alternate bars shall overlap each other in the manner shown, the left hand section of Fig. 1 showing the teeth as they appear when breaking up the clinker, and the right hand section showing the teeth in their normal position. These bars are supplied in single, double, or triple sets or sections, the sizes at present supplied ranging from 7½ ft. square to 6 ft. long by 3 ft. wide, although any length or width required can be fitted, the utmost satisfaction being given in every case where they have been supplied. We need scarcely say that the number of the bars and the number and length of the teeth varies with the nature of the work to be done. The bars are placed across the firegrate space upon bearers which run the length of the furnace. The bearers are suitably notched for the bars, and are bolted to the dead plate and bridge plate, the bars being provided with pivots which rest in the bearer notches. A rocking arm, under the dead plate and in line with the centre of the firegrate, is provided with a socket for an agitating lever by which motion is imparted to the bars in the following manner:—The odd number bars are attached to one end of the rocking arm, and the even number bars to the other end by means of right-and-left-hand connecting links, as shown in Fig. 1. The teeth in the rocking motion never become disengaged, for whether the teeth point upwards or downwards they always remain in gear with each other, and the bars cannot get out of the bearers.

The bars may be set at any angle up to 45 degrees without the use of locking gear, as one-half of the bars always balances the other half, an advantage that should not be lost sight of, as all other kinds of rocking bars are single-acting, and, consequently, requiring pinning or locking after being moved.

When the lever is inserted in the rocking arm, and the arm is oscillated, the odd number bars always incline in a contrary direction to the even number bars, and the grate then becomes wavy on the surface, as shown by Fig. 1, the points of the rising teeth tearing up the clinker, whilst in assuming the normal, or level, position the teeth are not liable to be stopped by loose hard substances on the grate.

This form of bar gives a greatly increased air space per foot of surface, and as the whole of this surface can be instantly cleared, consequently a more perfect combustion is ensured, while from their form each bar is interchangeable, and therefore two or three new bars may be put in as required.





The bars are the invention of a thoroughly practical engineer who has had many years' experience afloat and is fully acquainted with all the requirements of a bar to ensure rapid, enonomical, and uniform firing. In all cases where these bars have been fitted there has been an almost total prevention of smoke and a saving of fuel

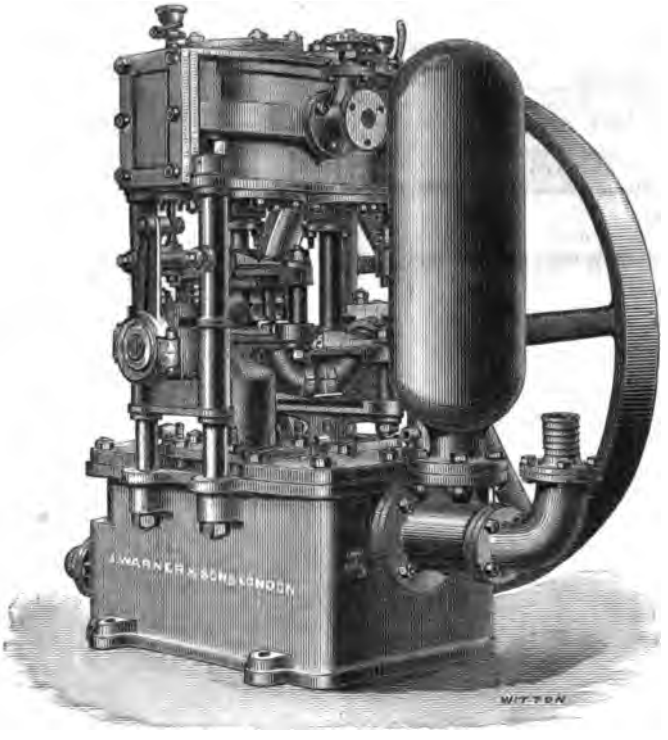
varying from 10 to 30 per cent., while the power of the boiler has been so increased, owing to absence of soot from the plates and tubes, that seven boilers with these rocking bars have been proved to generate as much steam as eight boilers with ordinary bars.

In addition to their importance to marine engineers and general users of steam power, they are being extensively adopted in the destruction of town refuse by cremation in several large manufacturing centres of the north and are giving the utmost satisfaction.

The models can be seen and all information will be gladly given by Messrs. Crompton & Compton, 19, Gracechurch Street, E.C.

WARNER'S PATENT DUPLEX ECLIPSE STEAM PUMPING ENGINES.

THE accompanying illustration represents typically a very compact and powerful form of steam pumping engine, designed and supplied by the makers, Messrs. John Warner & Sons, The Crescent Foundry, Cripplegate, London, E.C., in a variety of sizes and combinations, to suit various purposes and requirements, and to meet the wants of the present day.



The pump, as will be seen from the illustration, has the steam cylinders directly over the pump rams, and working on to a central crank shaft, the cut-off being effected by means of eccentrics placed on each side.

Every part is easy of access, all the working parts are of a simple type, and all wearing surfaces are amply large in their proportions. For boiler feeding, circulating, fire-extinguishing, and in fact for every variety of water-pumping, these pumps possess the three great qualifications of simplicity, effectiveness, and reliability. The Eclipse Steam Pumping Engines are made with triple as well as with duplex rams. Pumps of this type have recently been put to a novel use, and one which may certainly claim to rank as a new feature in submarine engineering. We allude to the use of the pump for supplying "hydraulic crowbars" for clearing the sand and stones from the bottom of the sea during the course of the construction of the harbour now being made at Grand Canary.

The contractors, writing of this application of the pump, say, "It *removes the sand two metres thick*, and *even large stones speedily*, under a head of 40 or 50 feet, thus *greatly facilitating* the progress of our breakwater works." We need scarcely say that it was necessary to remove the sand to enable the contractors to lay their concrete foundation blocks upon the rocks underlying the sand; and as there were also stones of considerable size to be removed (and the whole of the work to be carried out under water), the process was one of considerable difficulty for the divers. However, with the jet of water delivered by the Duplex Eclipse Pumping Engine, the sand was easily blown away so as to allow the concrete blocks to be placed in position, the stones, which were embedded in the sand, being also removed by the jet process from positions where an ordinary crowbar could not have been applied, and would consequently have been useless.

The pumping engine which produced this powerful jet, or "hydraulic crowbar," was of the type shown in our illustration, the diameter of the nozzles being $\frac{3}{4}$ in., 1 in., or $1\frac{1}{4}$ in., and the pressure of water at the nozzle equalled, approximately, 80 lb. per square inch.

We would commend the very important results obtained to the notice of all civil engineers, dock and harbour authorities, etc., to any of whom, interested in the question, we have no doubt Messrs. Warner would gladly supply fuller information.

GELL'S PATENT METHOD OF CARRYING AND WORKING SHIPS' BOATS.

THE accompanying illustrations represent a simple, practical, and reliable method of carrying and working ships' boats, invented and designed by Capt. W. J. Gell, of 3, West Seacombe Terrace, Percy Road, Seacombe, a master mariner of over thirty years' standing. This system of carrying and working boats gained the Gold Medal at the Liverpool International Exhibition of 1886.

Some years ago Captain Gell had the privilege of saving the crews of two ships which he fell in with in the North Atlantic during very bad weather. The delay he then experienced getting out his boats, which were fitted with ordinary gear, induced him to try and improve on the system, which has resulted in the simple methods herewith illustrated.

Turning now to the invention itself, it will, as shown by the accompanying, be seen to be one of extreme simplicity. From Fig. 1, a side view, and Fig. 2, an end view of the apparatus, it will be seen that there are two parallel troughs, or runners, in which the sets of chocks, one for each end of the boat, run. These chocks consist of an upper part shaped to the contour of the boat, and a lower or flat part, sliding in the troughs or runners,

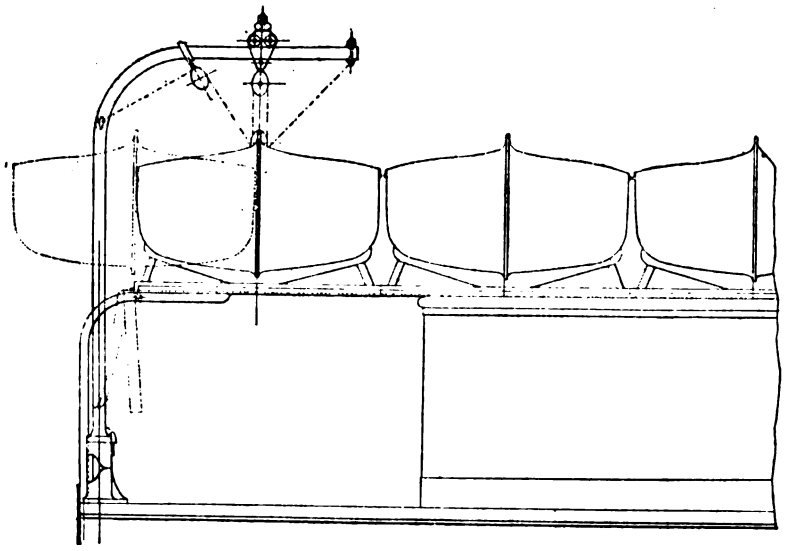


Fig. 2.

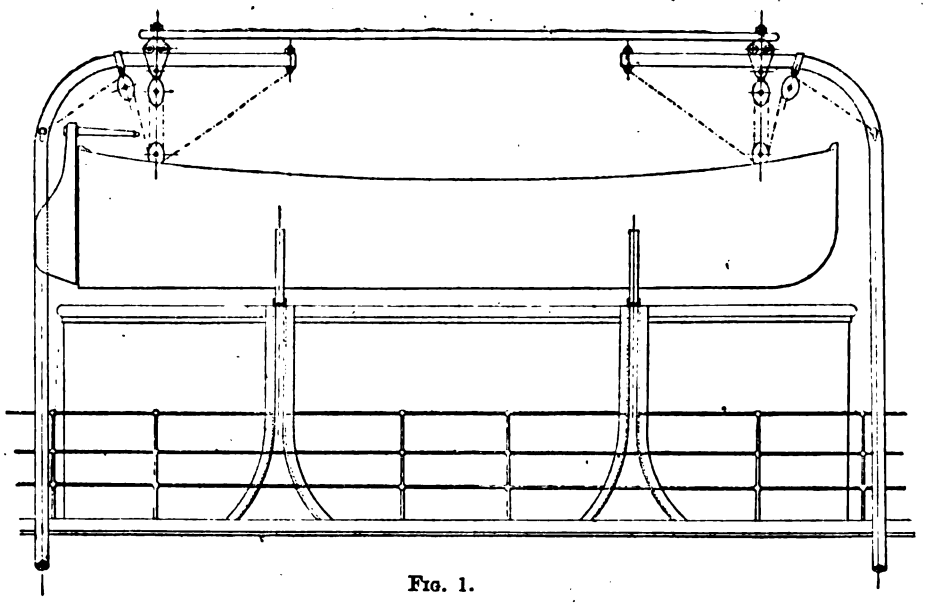


Fig. 1.

Fig. 5.

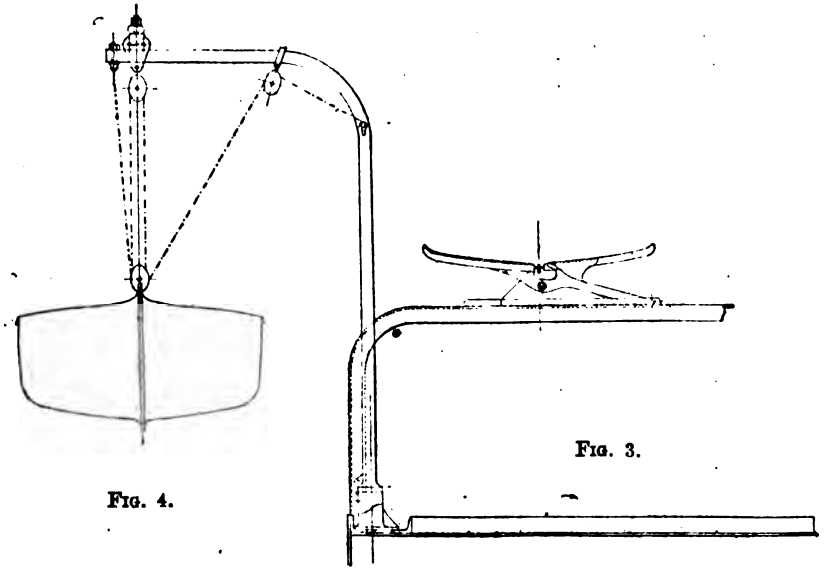


Fig. 4.

Fig. 3.

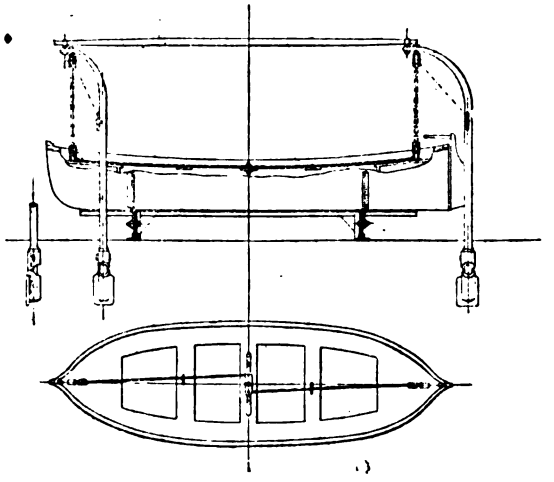


Fig. 6.

GELL'S PATENT METHOD OF CARRYING AND WORKING SHIPS' BOATS. (See page 332.)

which thus serve as guide rails to the chocks, the upper curved parts being connected to the lower flat parts by the short and nearly vertical pieces, as shown in Fig 2. The troughs, or guide rails, are carried from side to side of the ship so as to allow of launching on either the port or starboard side as required, davits being provided on both sides for that purpose.

The mode of action is as follows :—A series of boats and chocks occupy the troughs or runners, the outside boats having the davit tackles hooked on to them and hauled tight and made fast, the davits, as shown in Fig. 1, being placed about two feet further apart than the length of the boats, and made so that the blocks slide in and out on the head of them so as to obviate the usual time-wasting, and dangerous to life and limb process of having to shove the boat alternately forward and aft to get her out ready for lowering away. With this system to put a boat out, it is only necessary to withdraw the fastenings, push the boat out till the first chocks hang down clear of the end of the guide rails, or runners (as shown in dotted lines in Fig 2), when the davits rotate on the cam-like bases with which they are provided, and causing the blocks to slide out on the head of the davits until they are in a position for lowering the boat, when it is only necessary to lower away and disengage the boat. If

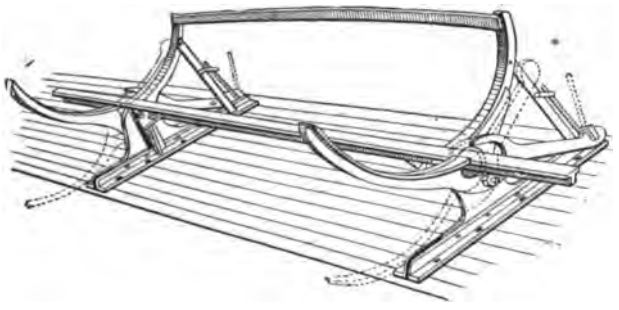


Fig. 7.

several boats have to be launched in succession, as in the case of a shipwreck, the empty chocks of the first boat can be easily cleared of the runners (see Fig. 1) and taken down on deck, and the next boat launched in the same way, thus admitting of all the boats of a series being launched from the lee side of the ship.

In Fig. 3 a chock is represented on a beam or skid, and having its outer arm constructed to work on a pivot, in order to avoid having to hoist the boat to cant the chock, while the T iron shown supports the keel for nearly the whole length of the boat.

To liberate the boat from the chocks, they are formed with one half pivoted or hinged on the other. (This is better seen in the larger isometrical elevation, Fig. 7.) The inner arm of the falling chock is made with a projecting horn, so that when the inboard arm of the falling chock is relieved, and the outer arm falls, the projecting horn comes against the keel of the boat, and is used as a lever to force the boat off the T iron it sits on ; and the weight of the boat being thus thrown on the davits they, by reason of the double cam arrangement at their bases, at once swing outwards, and the boat is ready for lowering, as shown by Fig. 4. A general side view of a boat, set in chocks, is given at Fig. 5, the arrangement with davits and cams being such as is used for boats carried two feet or more from the deck, while Fig. 6 is a plan of a boat showing the detaching apparatus, which is not automatic. It is worked by hand, and, as shown, is formed of two rods. The forward and after ends go through two bearings, and the other ends are connected to a cross head placed on one of the seats. By moving the cross head in one direction the forward and after ends of the rods (which form locking pins) are withdrawn from the bearings, and the tackles being hooked to the ends of the rods are thereby released and the boat let go at both ends simultaneously, at the will of the officer, and whether she is water borne or not.

Having thus fully described Capt. Gell's invention, we would, if only on account of its having successfully proved itself, by actual trial, to be what its inventor claims for it, commend it to the favourable notice of our readers.

THE "HOPCRAFT" PATENT FURNACE.

ON the 20th ult. a party of gentlemen were invited to practically inspect and notice that which is designated by the Inventor as a "Mechanical underfeeding, self-stoking, and smokeless Furnace Grate for use with ordinary or forced draught," and among the company present we were pleased to meet several eminent scientific experts and others interested in respect to the important objects desired, where steam as a motor requires the all-present important element of coal for internally fired boilers, notably among whom was D. K. Clark, Esq., C.E., Engineer to the National Smoke Abatement Institution, who has been engaged in conducting numerous experiments in connection with the subject under notice, and his reports are highly favourable.

On board the Victoria Steamboat Association's Steamer *Lotus*, on arrival off Greenwich, we were glad to have the opportunity of witnessing Mr. Hopcraft's Patent Furnace arrangements in practical use as fitted on the above vessel.

As is well known, small coal and coal dust is not favourable under ordinary conditions for steam generating purposes, but what we closely observed was that "Hopcraft's" system is specially designed and adaptable for the use and consumption of what may commercially be termed as "refuse fuel."

The furnace under notice is so constructed that the fuel is supplied or led from underneath the furnace grate in conjunction with a mechanically induced forced draught, together with an automatic and continuous supply of fuel and air, under control in the requisite proportions, and consists of a revolving circular grate with a central under-feed and a forced blast designed for burning coal slack. The grate slowly revolves on its axis which is inclined towards the bridge at an angle, the fuel being fed into a hopper and falling downward therefrom by reason of gravity towards a curved connection at the lower level, and is then mechanically and automatically elevated to the higher level by means of a propelling or Archimedean form of screw, and into the incandescent fuel on the grate surface combustion chamber.

The system appeared in course of the trial as witnessed by us to be very effective as a smoke preventer, and that Welsh dust or bituminous Midland small coal, as used, was successfully burned in the grate, and in point of duty and economy, as compared with hard steam or other coal of superior quality, should prove, so far as we have seen, a great boon for both sea and land purposes as an accessory to ordinary boiler furnaces to which it can be readily fitted.

We were informed by the managing director of the

Victoria Steamboat Association Company (Arnold Williams, Esq.) that in addition to the vessel referred to and fitted with the "Hopcraft" Patent Furnace, that he was so far satisfied with its practical results and the great economy effected throughout, as to have given orders for several other vessels built and under construction for his Company to be likewise altered and so adapted.

In our next issue, if space permits, we purpose to fully illustrate and give a further practical description in detail of Mr. Hopcraft's invention.

DOWNTON'S PATENT SUPPLEMENTARY FEED.

THE accompanying illustration represents a very simple and effective form of supplementary feed apparatus, which is now being put on the market by Messrs. J.

Downton & Co., of 71, West India Dock Road, E., and which, so far as it has yet been tried, has given very satisfactory results.

We need scarcely remind our readers of the great importance, in these days of high pressures, of supplying boilers with pure fresh feed water to make up the waste, nor need we point out how, with the present high temperatures, all the lime salts contained in the sea water are rapidly deposited as scale; but as it is a well known fact that $\frac{1}{16}$ of an inch of scale on the heating surfaces of a boiler is equal to a loss of efficiency of 20 per cent. in evaporative power, we may perhaps be permitted to say that it behoves all steamship owners, if they wish to make profits in these competitive times, to look well after the quality of the water that goes into their boilers. So deeply do the Admiralty think on this point that they have adopted the principle of double distillation of all feed water. In Messrs. Downton's apparatus, as herewith illustrated, the salt water is condensed into fresh and supplied direct to the hot well without the intervention of any pump or other machinery, and by this means the dangerous practice of supplying the boiler straight from the sea, with the frequent resultant of cracked furnace plates, is entirely done away with, while the supply of hot fresh water effects great economy of fuel and greatly prolongs the life of the boiler.

As will be seen from the illustration the salt water is let in at the opening D, while a small steam pipe leads from the main boiler to the inlet at B. The steam entering at B passes through it, and enters a coil, or worm, after traversing which it exhausts at C, and so passes straight to the hot well. The steam in its passage through the coil, or worm, heats up the salt water and the steam from this (in the form of pure water vapour) escapes at the outlet A, and is lead direct to either the hot well or the condenser. The blow off, or sludge, cock, E, may be connected to either bilge or bilge pump.

The whole apparatus is extremely simple, the only attention necessary being to open the various cocks as the make up of the feed may require, and as no steam is wasted from the boilers, there being no waste, or exhaust, whatever, the apparatus is very economical in use.

We would strongly recommend those of our readers who are troubled with "scaly" boilers to give Messrs. Downton's Patent Supplementary Feed a trial, and as the name of the firm is sufficient guarantee for good workmanship and materials we are confident that they will have no cause to regret doing so.

THE BELGIAN GOVERNMENT MAIL SERVICE.—The fleet of the Belgian Government Mail Service between Dover and Ostend has received the addition of a new steamer, which the makers assert to be the fastest boat on the Channel service. This is *La Flandre*, a paddle steamer of 900 tons burden, 271 ft. 8 in. long, by 29 ft. beam, drawing loaded 8 ft. 6 in. of water, including keel, built by the Société John Cockerill, of Seraing. The boilers have 7,300 square ft. of heating surface, forced draught being given by two fans. The normal pressure is 8 atmospheres, or 120 lb. per square in. and, with high and low pressure cylinders of 50 in. and 97 in. respectively, by 6 ft. stroke, the engines develop 3,700 H.P. During the official trial, however, on December 1, between Nieuport and La Panne, more than 4,000 H.P. was indicated, giving a mean speed of nearly 19 knots an hour for two runs of 8½ nautical miles with, and two against, the tide. The speed contracted for was 17½ knots an hour, and the makers are entitled to a premium of £400 for each tenth of a knot in excess of that rate, subject, however, to a certain limit. The trial gave the utmost satisfaction to the officials of the Belgian government, at the head of whom was M. Michel, Inspector-General of Marine. A sister vessel is on the stocks at the Cockerill Company's Hoboken shipyard, near Antwerp, and will shortly be launched.

LIST OF VESSELS LAUNCHED IN 1888.

ENGLISH.

By Joseph L. Thompson & Sons, North Sands, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Beethoven	Steel	Steam	British	2,216	200
† Birchfield	,,	,,	,,	2,327	250
† Resolution	,,	,,	,,	1,979	180
† Zeta	,,	,,	,,	2,334	200
† Crest	,,	,,	,,	2,064	180
† Discovery	,,	,,	,,	1,983	180
† Enterprize	,,	,,	,,	1,981	180
† Northumbria ..	,,	,,	,,	1,981	180
† Ruysdael	,,	,,	,,	2,128	250
† Netherholme ..	,,	,,	,,	1,969	180
† Wm. Branfoot ..	,,	,,	,,	2,022	200
† Charlton	,,	,,	,,	1,925	180
† Bishopsgate ..	,,	,,	,,	2,242	230
† Conde Wilfredo ..	,,	,,	Foreign	3,800	600
† Byron	,,	,,	British	2,150	250
† Cycle	,,	,,	,,	2,020	200

By Edwards & Symes, Cubitt Town, London, E.

Sir Edward Blakeney	Wood	Sail	British	10	—
John Lawson	,,	,,	,,	10	—
‡ Presidente Juarez Celmau	Steel	Steam	Foreign	40	20
Barge	,,	—	,,	10	—
Barge	,,	—	,,	10	—
Barge	,,	—	,,	10	—
Barge	,,	—	,,	10	—
‡ Puffin	,,	Steam	British	15	10
* No. 211	,,	,,	Foreign	30	20
Barge	Iron	—	,,	60	—
Barge	,,	—	,,	40	—
Barge	Steel	—	,,	10	—
Barge	,,	—	,,	10	—
* Mavourneen ..	,,	Steam	British	15	12
Barge	,,	—	Foreign	70	—
Barge	,,	—	,,	70	—
* La France	Iron	Steam	,,	400	50

By Short Bros., Pallion, Sunderland.

† Asiatic Prince ..	Steel	Steam	British	2,183	200
† Scottish Prince ..	,,	,,	,,	1,959	180
† Diligent	,,	,,	,,	2,185	180
† Gerent	,,	,,	,,	2,283	180
† Vedra	,,	,,	,,	2,890	350
† Rio Tinto	,,	,,	,,	2,166	180
† Cyrene	,,	,,	,,	3,032	250
† Snilesworth ..	,,	,,	,,	2,206	180
† British Prince ..	,,	,,	,,	2,217	200
† John Sanderson ..	,,	,,	,,	3,363	250

By Yarrow & Co., Poplar, London.

One boat	Wood	—	British	—	—
One boat	,,	,,	,,	—	—
Two hulls	Steel	Steam	Foreign	—	—
One steamer	,,	,,	British	—	—
One paddle-wheel boat	,,	,,	Foreign	—	—
One launch	,,	,,	British	—	—
One torpedo boat ..	,,	,,	Foreign	—	—
Two boats	Wood	—	British	—	—
Two boats	,,	,,	,,	—	—
One launch	Steel	Steam	,,	—	—

By Richardson, Duck & Co., South Stockton-on-Tees.

† Clandeboye	Steel	Steam	British	2,195	170
† Sapphire	Iron	,,	,,	2,058	200
† Rosario	Steel	,,	,,	1,232	110
† Lundy	,,	,,	,,	1,827	160
† Volturno	,,	,,	,,	2,336	200
† Hawkhurst	,,	,,	,,	2,339	200
† Mary Anning ..	Iron	,,	,,	2,057	200
† Start	Steel	,,	,,	2,339	200
† Afghanistan ..	Iron	Sail	,,	2,286	—

* Compound. † Triple. ‡ High Pressure.

By Edwd. Withy & Co., West Hartlepool.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Merida	Steel	Steam	British	2,280	250
† Nith	,,	,,	,,	2,284	200
† Oswestry	,,	,,	,,	2,418	250
† Grenville	,,	,,	,,	1,564	140
† Juno	,,	,,	,,	2,403	220
† Era	,,	,,	,,	2,378	250
† Ursa	,,	,,	,,	2,735	260
† Chicklade	,,	,,	,,	2,378	250
† Kennett	,,	,,	,,	1,643	150

By W. H. Potter & Sons, Queen's Dock, Liverpool.

Seafarer	Steel	Sail	British	2,211	—
† Hydra	,,	Steam	,,	990	120
Barge	Iron	—	,,	100	—
,, ...	,,	—	,,	100	—
,, ...	,,	—	,,	100	—
,, ...	,,	—	,,	100	—
,, ...	,,	—	,,	100	—
,, ...	,,	—	,,	100	—

By J. F. Wadlington & Co., Seacombe, Liverpool.

‡ Sunbeam	Steel	Steam	British	25	12
Tukoja	,,	—	,,	20	—
* Euxine	,,	Steam	,,	180	40
* Sternwheeler ..	,,	,,	Foreign	300	70
* Cruzierio	,,	,,	,,	75	30
‡ Barge	Iron	,,	British	50	12

By T. Turnbull & Sons, Whitby.

† Falshaw	Steel	Steam	British	2,422	175
† Northgate	,,	,,	,,	2,414	175
† Excelsior	,,	,,	,,	1,861	140
† Cyril	,,	,,	,,	2,362	175
† Thordisa	,,	,,	,,	2,358	175
† ———	,,	,,	,,	1,850	140

By The Blyth Shipbuilding Co., Limited, Blyth.

† Godmunding ..	Iron	Steam	British	1,319	150
† Rapel	Steel	,,	Foreign	1,193	110
† Sultana	Iron	,,	British	1,980	180
† Wm. Morphy ..	,,	,,	,,	659	60
† Peace	Steel	,,	,,	1,700	160

By H. S. Edwards & Son, Howdon-on-Tyne.

* Felipe Lussich ..	Iron	Steam	Foreign	227	25
† Mimosa	Steel	,,	British	1,557	140
† Shearwater ..	,,	,,	,,	952	150
† Lady Brassey ..	,,	,,	,,	247	75
† Eleanor	,,	,,	,,	1,911	160

By W. Pickersgill & Sons, Southwick, Sunderland.

† Shing Sheng ..	Steel	Steam	Foreign	1,185	130
† Amy	,,	,,	British	2,336	230
† Lyndhurst	,,	,,	,,	2,025	180
† Ricardo	,,	,,	,,	1,300	130

By Craig, Taylor & Co., Stockton-on-Tees.

† Rosecliffe	Iron	Steam	British	2,298	180
† Persian Prince ..	,,	,,	,,	2,283	185
† Hessle	,,	,,	,,	1,938	160

By Royden & Sons, Queen's Dock, Liverpool.

† Indra	Steel	Steam	British	3,581	256
† Indrani	,,	,,	,,	3,584	256
Buckingham ..	,,	Sail	,,	2,667	—

By J. T. Eltringham, Stone Quay, South Shields.

Wexford	Iron	Steam	British	141	80
Earl of Dunraven ..	,,	,,	,,	174	98
*Tudor Prince ..	,,	,,	,,	78	30
†Goole No. 7	,,	,,	,,	138	75
Lady Helen	,,	,,	,,	85	45
*Newburgh	,,	,,	Colonial	78	50
*Otter	,,	,,	British	117	45
*Premier	,,	,,	,,	80	40

* Compound. † Triple. ‡ High Pressure.

By W. Gray & Co., West Hartlepool.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Urania	Steel	Steam	British	2,591	220
† Kittie	,,	,,	,,	2,212	190
† Harrow	,,	,,	,,	2,586	220
† Crathorne	,,	,,	,,	2,752	250
† Evelyn	,,	,,	,,	2,400	200
† Magda	,,	,,	,,	2,405	200
† Lowlands	,,	,,	,,	1,789	150
† Huxworth	,,	,,	,,	2,437	200
† Swainby	,,	,,	,,	2,736	250
† Duke of Cornwall ..	,,	,,	,,	1,815	150
† New Borough ..	,,	,,	,,	1,795	150
† Cranford	,,	,,	,,	2,293	220
† Carrie	,,	,,	,,	1,789	150
† Egglestone Abbey ..	,,	,,	,,	2,401	200
† Humber	,,	,,	,,	2,198	250
† Marie	,,	,,	Foreign	2,059	160
† Norwood	,,	,,	British	2,352	200
† Wandsworth ..	,,	,,	,,	1,750	160
† Missouri	,,	,,	,,	2,950	300
† Muriel	,,	,,	,,	2,400	200
† Leven	,,	,,	,,	2,437	200
† Karoon	,,	,,	,,	2,160	180

By Raylton, Dixon & Co., Middlesbrough.

† Pallas	Steel	Steam	British	3,248	350
† Fulford	,,	,,	,,	1,829	150
† Guy Colin	,,	,,	,,	2,234	250
† Legislator	,,	,,	,,	2,997	400
† Nigretia	,,	,,	,,	2,477	200
† Nordkap	,,	,,	Foreign	2,091	175
† Longstone	,,	,,	British	2,360	220
† Erimus	Iron	Paddle	,,	176	45
† Eugenie	Steel	Steam	Foreign	2,300	200
† Echuca	,,	,,	British	2,834	400
† Jago	,,	,,	,,	2,404	220
† Alhena	,,	,,	,,	2,345	220

By Forrestt & Son, Norway Yard, Limehouse, London, and Wyvenhoe, Essex.

Vessels built at Norway Ford, Limehouse.

Violet	Wood	Steam	British	5	—
Nettle	,,	,,	,,	3	—
Steam Launch ..	,,	,,	,,	6	—

Fifteen 21 ft. Steam Life Cutters for British Admiralty.
Coast Life-boat for Gibraltar.

Vessels built at the Shipyard, Wyvenhoe, Essex.

*Enterprise	Composite	Steam	British	15	8½
*Twin-screw Launch	Steel	,,	Foreign	10	5
* ,, ,, ,,	,,	,,	,,	10	5
,, ,, ,,	,,	,,	,,	10	5
Whale Boats	,,	Sail	,,	7	—
,, ,, ...	,,	,,	,,	7	—
,, ,, ...	,,	,,	,,	7	—
,, ,, ...	,,	,,	,,	7	—
Lighter	,,	,,	,,	8	—
*Stern Wheel Steamer	,,	Steam	,,	56	30
Yawl	Wood	Sail	—	18	—
*Surprise	Iron	Steam	British	12	3

By Cochrane, Cooper & Schofield, Grove Hill, Beverley.

* Staffa	Iron	Steam	British	144	45
* Iona	,,	,,	,,	144	45
† Nile	,,	,,	,,	130	50

By Wm. Doxford & Sons, Pallion, Sunderland.

† Julio	Steel	Steam	Foreign	1,799	160
† Brenner	,,	,,	British	1,878	160
† Callisto	,,	,,	Foreign	1,709	130
† Chamois	,,	,,	British	1,879	160
† Tangier	,,	,,	,,	1,880	160
† Hamburg	,,	,,	Foreign	756	130
† Kong Frode ..	,,	,,	,,	1,006	100
† Banan	,,	,,	,,	1,006	100
† Daniel	,,	,,	British	2,125	200

* Compound. † Triple.

By S. P. Austin & Son, West Dockyard, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Pallas	Steel	Sail	Foreign	1,454	—
† Orkla	,,	Steam	British	2,070	200
† Carl Hirschberg ..	,,	,,	Foreign	1,310	140
† Barmston	,,	,,	British	1,374	160
† Urpeth	,,	,,	,,	1,103	130

By Robert Thompson & Sons, Southwick Yard, Sunderland.

†Muke Marn ..	Steel	Steam	Foreign	3,197	250
†Drumburlie ..	,,	,,	British	2,446	220
*Portalade	,,	,,	,,	633	90
†Drumfell	,,	,,	,,	2,390	220

By Oswald Mordaunt & Co., Southampton.

† Remus	Steel	Screw	British	218	50
† Romulus	,,	,,	,,	274	50
† Jessmore	,,	,,	,,	2,465	230
Scottish Lochs ..	Iron	Sail	,,	2,640	—
Ville de Dieppe ..	Steel	,,	French	1,279	—
† Rock Light	,,	Screw	British	3,175	250

By John Readhead & Sons, South Shields.

† Trelawny	Steel	Steam	British	1,657	170
† Lizzie	,,	,,	,,	827	90
† Charters Tower ..	,,	,,	,,	2,926	300
† Harperly	,,	,,	,,	2,232	250
† Othow Stathatos ..	,,	,,	Foreign	1,827	200
† Jane Jolliffe ..	,,	,,	British	234	200
† Isle of Anglesey ..	,,	,,	,,	1,274	115
† Trawavas	,,	,,	,,	1,632	170
† Millfield	,,	,,	,,	2,168	250
† Thorntondale ..	,,	,,	,,	2,153	250
† North Flint ..	,,	,,	,,	2,170	250
† North Gwalia ..	,,	,,	,,	2,171	250
† Blakemoor	,,	,,	,,	1,768	170

By The Whitehaven Shipbuilding Co., Whitehaven.

† Tropic	Steel	Steam	British	1,763	160
Galgate	,,	Sail	,,	2,361	—
Lord Shaftesbury ..	,,	,,	,,	2,350	—
Dunboyne	Iron	,,	,,	1,425	—
No. 1 Hopper Barge ..	Steel	—	,,	70	—

Samuda Bros., Limited, Poplar, E., London.

Trent Dredger ..	Steel	—	British	87	—
Lac Copais Dredger ..	,,	—	Foreign	167	—
Pontoon	,,	—	,,	14	—
,, ...	,,	—	,,	14	—

By the Tyne Iron Shipbuilding Co., Limited, Willington Quay.

† Lancelot	Steel	Steam	British	2,379	330
† Wileysike	,,	,,	,,	2,468	220
† Ambassador ..	,,	,,	,,	2,511	220
† Brunel	,,	,,	,,	2,003	220
† Helvetia	,,	,,	Foreign	2,850	300

By Edward Finch & Co., Ltd., Chepstow.

* Antonio	Steel	Steam	Foreign	19	10
* The Marchioness ..	,,	,,	British	262	130
10 Barges	,,	,,	,,	1,150	—
2 Barges	,,	,,	Foreign	140	—
1 Barge	,,	,,	,,	30	—

By Elliot & Jeffery, West Bute Docks, Cardiff.

* Lady Morgan ..	Iron	Steam	British	52-55	40

By Wm. White & Sons, West Cowes, Isle of Wight.

* Linotte	Composite	Steam	Foreign	70	25
* Bombay	Steel	,,	,,	33	15
* Witty	Wood	,,	,,	10½	2½
* Berners	,,	,,	British	10½	2½

By J. Priestman & Co., Southwich, Sunderland.

* Gemini	Iron	Steam	British	996	100
† Quickstep	,,	,,	,,	996	100

* Compound. † Triple.

By Osbourne, Graham & Co., Hylton, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	Length Beam.	H.P. N.
† Kathleen	Steel	Steam	British	1,700	160
† Elfreda	,,	,,	,,	2,300	200

By Cook, Welton & Gemmell, South Bridge Road, Hull.

*Vanguard	Iron	Screw	British	134	45
*General Roberts ..	,,	,,	,,	142	45
†Hereward	,,	,,	,,	108	60
*Rangoon	,,	,,	,,	129	45
*Dogger Bank ..	,,	,,	,,	135	45
*Prime Minister ..	,,	,,	,,	135	45
*Lord Chancellor ..	,,	,,	,,	135	45
*Resolute	,,	,,	,,	131	45
*Mizpah	,,	,,	,,	131	45
*No. 31	,,	,,	,,	131	45
*Sir Albert Rollit ..	,,	,,	,,	135	45

By Schlesinger, Davis & Co., Wallsend, Newcastle-on-Tyne.

† Tynesider	Steel	Steam	British	1,331	350
† South Briton ..	Iron	,,	,,	1,587	150
† Marghenta	Steel	,,	Foreign	598	70
* Orestes	Iron	,,	British	1,778	180

By Steward & Latham, South Docks Iron Works, Poplar, E.

* Countess of Lathom	Steel	Steam	British	386	100
* Countess of Zetland	,,	,,	,,	386	100
† Llambi Campbell ..	,,	,,	Foreign	68	30

By John Blumer & Co., North Dock Shipbuilding Yard, Sunderland.

Hampton	Steel	Steam	British	2,128	200
Oeylon	,,	,,	Foreign	2,235	200
Sneaton	,,	,,	British	1,457	130

By Bartram, Haswell & Co., South Dock, Sunderland.

† Maple Branch ..	Steel	Steam	British	2,637	300
† Beatrice	,,	,,	,,	2,241	250
† Britannic	,,	,,	,,	2,302	250

By Ropner & Son, Stockton-on-Tees.

* Progress	Iron	Steam	British	220	35
† Terra	Steel	,,	,,	2,725	220

By Newall & Co., St. Philips' Iron Works, Bristol.

* Tavistock	Steel	Steam	British	70	50
* Portichol	,,	,,	Foreign	170	70

By R. & J. Evans & Co., Brunswick Dock, Liverpool.

* Neptune	Iron	Steam	British	137	80
* Gladova	,,	Sail	,,	1,057	

By Williamson & Son, Workington.

Silverorag	Steel	Sail	British	1,939	—
Aldebaran	,,	,,	German	1,943	—

By Cox & Co., Falmouth.

† Kathleen	Steel	Steam	British	190	95

By Strand Slipway Company, Sunderland.

† Unionist	Steel	Steam	British	2158	180

By C. S. Swan & Hunter, Wallsend-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† Gellivara	Steel	Steam	Foreign	2,608	2,000
† Avalon	,,	,,	,,	2,083	1,100
† Felbridge	,,	,,	,,	2,066	1,100
† Citta di Roma ..	,,	,,	,,	2,032	1,100
† Knutsford	,,	,,	British	2,073	1,100
† Iser	,,	,,	,,	2,178	1,050
† Arbib Brothers ..	,,	,,	,,	2,750	1,260
† Cæsar	,,	,,	Foreign	2,530	1,100

Compound. † Triple.

By Palmer's Shipbuilding & Iron Co., Limited, Jarrow-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Rufford Hall	Steel	Steam	British	3,959	2,650
Knight Companion ..	,,	,,	,,	4,005	2,650
Loch Lomond ..	,,	,,	,,	2,571	1,230
Cairnryan	,,	,,	,,	1,663	1,000
Ferrando	,,	,,	,,	2,090	1,100
Seamew	,,	,,	,,	1,505	2,860
Rosemorran	,,	,,	,,	2,470	1,340
Lavernock	,,	,,	,,	2,288	1,100
Ismailia	,,	,,	,,	3,136	1,700
Oka	,,	,,	,,	3,095	2,100
Marquesa de Santuree	,,	,,	Foreign	2,332	1,470
Palatine	,,	,,	British	2,042	1,100
Drever	,,	,,	,,	986	1,000
Glanystwyth	,,	,,	,,	1,824	1,000
Clarissa Radcliffe ..	,,	,,	,,	2,487	1,300
Rutherglen	,,	,,	,,	2,470	1,300
Apex	,,	,,	,,	2,118	1,100
Northwood	,,	,,	,,	765	1,000
Duquesa de Vistahermosa	,,	,,	Foreign	2,332	1,470
Argus	,,	,,	British	2,750	2,000
Victoria	,,	,,	,,	89	150
Princess Beatrice ..	,,	,,	,,	89	150
Melpomene	—	—	—	—	9,000
Saxmundham ..	—	—	—	—	1,300

By Cochran & Co., Birkenhead.

‡ Victoria	Steel	Steam	Foreign	40	50
* Vulcano	,,	,,	,,	25	50
† Jeannette	,,	,,	British	150	280
‡ Defence	,,	,,	Foreign	25	50
* Blanca	,,	,,	British	185	750
* Julia	,,	,,	,,	185	750
‡ Ibo	Wood	,,	Foreign	5	12
* Chileno	,,	,,	,,	20	50
* Progress	Steel	,,	British	40	80
Guayaquil	,,	Sail	Foreign	50	—
* Dorothy	Wood	Steam	British	4	10
‡ Oka	,,	,,	,,	20	20
Iona	,,	Sail	,,	3	—
* Lady Gordon ..	,,	Steam	,,	5	12
‡ Amarante	Steel	,,	Foreign	60	160
‡ Santo Estevas ..	,,	,,	,,	60	160
Manoos	Wood	Sail	,,	3	—
Boa Esperance ..	Steel	,,	,,	30	—
Cama Vierro	,,	,,	,,	30	—
* Wilhelm	Wood	Steam	,,	15	40
‡ Braillard	Steel	,,	,,	30	40
* Emilito	Wood	,,	,,	5	12
6 Junction boats ..	,,	Sail	British	60	—

By R. & W. Hawthorn, Leslie & Co., Hebburn, Newcastle-on-Tyne.

† Palestro	Steel	Steam	Foreign	3,352	1,800
† Kostroma	,,	,,	,,	3,513	2,700
† Cass	,,	,,	,,	1,395	2,600
† Smith	,,	,,	,,	1,395	2,600
† Alberta	,,	,,	British	3,398	1,800
† Gulf of Corcorado	,,	,,	,,	3,030	1,650
† Gulf of Guinea ..	,,	,,	,,	3,132	1,650
† Newton	,,	,,	,,	2,445	1,350
† Gulf of Guayaquil	,,	,,	,,	3,034	1,650
† Gulf of Martaban ..	,,	,,	,,	3,136	1,650

By Sunderland Shipbuilding Company, Sunderland.

* C. A. Bade	Steel	Steam	Foreign	592	500
† Chanzy	,,	,,	,,	663	550
† Rosedale	,,	,,	British	1,040	600
† Wylam	,,	,,	,,	826	550
† Trifels	,,	,,	Foreign	2,766	1,500
† Elena Oms	,,	,,	,,	647	750
† Serica	,,	,,	British	2,700	1,500
† Melita	,,	,,	,,	976	500
† No. 150	,,	,,	,,	976	500

* Compound. † Triple. ‡ Non condensing.

By Sir W. G. Armstrong, Mitchell, & Co., Limited, Newcastle-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Piemonte	Steel	—	Foreign	2,470	11,600
Gaula	,,	—	,,	2,675	1,100
Castoe	,,	—	,,	330	350
Polluce	,,	—	,,	330	350
Caucase	,,	—	,,	1,644	750
Oevelgonne	,,	—	,,	2,539	1,050
Gut Heil	,,	—	,,	2,737	1,200
Elbruz	,,	—	British	2,715	1,200
Rasbek	,,	—	,,	2,707	1,200
Yang	,,	—	Foreign	465	350
Lux	,,	—	British	1,635	750
Sophie	,,	—	Foreign	1,362	650
8 Petroleum Barges ..	Iron	—	,,	672	—
Darial	Steel	—	British	2,750	1,200
Russian Prince ..	,,	—	,,	2,716	1,200
La Flandre	,,	—	,,	2,044	900
Energie	,,	—	Foreign	2,750	1,200

Wm. Dickinson, Birkenhead.

Launch 50 ft.	Wood	Screw	Foreign	20	40
Launch 35 ft. ..	,,	,,	,,	15	35
Launch 35 ft. ..	,,	,,	,,	15	35
Launch 35 ft. ..	,,	,,	,,	15	35
Launch 69 ft. ..	,,	,,	,,	40	75
* Lagos 35 ft ..	,,	,,	,,		55
Lifeboat Launch ..	,,	,,	,,	10	30
Launch 27 ft. ..	,,	,,	,,	5	18
Yachts Launch ..	,,	,,	,,	1	1½
Centre Board Boat ..	,,	Sail	British	1	
Whaler Lifeboat ..	,,	,,	Foreign		
Centre Board Yacht ..	,,	,,	British	3	
Barge	,,	Tow	Foreign	25	
‡ Paul Bert	,,	Screw	,,	20	45
Barge	,,	Tow	,,	18	
† Launch	Steel	Screw	British	7	34

By Earle's Shipbuilding & Engineering Co., Limited, Hull.

† Samson	Iron	Steam	British	86	275
‡ Virgo	,,	,,	,,	145	250
† Frankfort	Steel	,,	,,	1,019	1,010
† Gotha	,,	,,	,,	654	1,210
† Equity	Iron	,,	,,	764	1,495
† Colchester	Steel	,,	,,	1,196	2,200
† Marple	,,	,,	,,	104	425
† Grimsby	,,	,,	,,	300	1,100
† Oldham	Iron	,,	,,	890	1,400
† Arctic	,,	,,	,,	154	285
† Eton	,,	,,	,,	144	250
† Baltic	,,	,,	,,	154	285

William Dobson & Co., Low Walker, Newcastle-on-Tyne.

Ouse Hopper No. 5 ..	Iron	Steam	British	213	140
Ouse Hopper No. 6 ..	,,	,,	,,	213	140
Benmore	Steel	,,	,,	1,521	960
Candid	Iron	,,	,,	1,410	720
Derwent	Steel	,,	,,	782	1,195
Italia	Iron	,,	Foreign	782	500
Tritao	,,	,,	,,	156	500
Tainha	,,	Sail	,,	157	—
Phoca	,,	,,	,,	157	—
Port Caroline ..	Steel	Steam	British	3,655	4,000

By Robert Stephenson & Co., Hebburn, Newcastle-on-Tyne.

† Endeavour	Steel	Steam	British	2,518	1,100
† Glen Caladh Tower	,,	,,	,,	3,607	1,700
† Hindoo	,,	,,	,,	3,628	1,850
Lightship	Composite	Sail	,,	210	—
Lightship	,,	,,	,,	210	—

By Wood, Skinner & Co., Bill Quay, Newcastle-on-Tyne.

† Gabalva	Steel	Screw	British	1,662	850
† Framnes	,,	,,	Foreign	1,526	800
* Jesmond	Iron	,,	British	178	220
† County Antrim ..	,,	,,	,,	1,960	850

* Compound. † Triple. ‡ High Pressure.

By Laird Bros., Birkenhead.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
* Unnamed (s. in pieces)	Steel	Steam	British	106	270
† Quito	,,	,,	,,	1,526	800
† Turner	,,	,,	Foreign	175	400
† Imperial	,,	,,	,,	2,380	3,000

By The Naval Construction & Armaments Co., Limited, Barrow-in-Furness.

* Freda	Steel	Steam	British	310	350
* Gerda	,,	,,	,,	310	350
Lifeboat	Wood	Sail	,,	10	—
Lifeboat	Steel	,,	,,	5	—

By Wigham Richardson & Co., Iron Shipbuilders, Newcastle.

Alfonso XII.	Steel	Steam	Foreign	5,063	5,000
Wilcannia	,,	,,	British	2,807	1,850
Glang-Ann	,,	,,	Foreign	872	900
Abydos	,,	,,	,,	2,197	1,800
Gracia	,,	,,	,,	3,076	2,100
Adelaide Savarello ..	,,	,,	,,	1,860	2,600

By James Laing, Deptford Yard, Sunderland.

Ville de Belfant ..	Steel	—	—	2,846	1,750
Ben Clune	,,	—	—	2,051	1,000
Engineer	,,	—	—	723	650
Edendale	,,	—	—	2,405	1,650
Ohio	,,	—	—	2,390	1,250
Wakefield	,,	—	—	2,389	1,250
Umtazi	,,	—	—	1,760	1,100
Asagao	,,	—	—	2,405	1,650

By John Jones & Sons, Brunswick Dock, Liverpool.

† Andriana	Steel	Steam	Foreign	1,823	1,100

Two small Iron Barges for the Panama Canal.

SCOTCH.

By Russell & Co., Port Glasgow and Greenock.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Ocean	Steel	Steam	Foreign	2,835	—
Charlois	,,	,,	,,	3,003	—
Virginia	,,	,,	British	2,314	—
Aldborough	,,	,,	,,	2,314	—
Strathblane	,,	,,	,,	2,341	—
Falls of Inversnaid ..	,,	,,	,,	2,669	—
Schichallion	,,	,,	,,	1,626	—
Spindrift	,,	,,	,,	3,060	—
Earl Rosebery ..	,,	,,	,,	1,264	—
Rio Branco	,,	,,	,,	556	—
Joás Alfredo	,,	,,	,,	556	—
Tinto Hill	,,	Sail	,,	2,144	—
Madagascar	,,	,,	,,	2,145	—
Robert Rickmers ..	,,	,,	Foreign	2,261	—
Glenalvon	,,	,,	British	2,146	—
Cap Horn	,,	,,	Foreign	2,626	—
Liverpool	—	,,	British	3,377	—
Pitcairn Island ..	—	,,	,,	1,359	—
Norfolk Island ..	—	,,	,,	1,359	—
Port Carlisle	—	,,	,,	1,385	—
Andrew Welch ..	—	,,	Foreign	885	—
Firth of Cromarty ..	—	,,	British	1,528	—

By Birrell, Stenhouse & Co., Dumbarton.

Buteshire	Steel	Sail	British	1,905	—

By David MacGill & Co., Irvine, N.B.

* Marianela	Steel	Steam	Foreign	112	33

By Campbeltown Shipbuilding Co., Campbeltown, N.B.

† Bramble	Steel	Steam	British	1508	170

* Compound. † Triple.

By ALLEY & MACLELLAN, Polmadie, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
1 Pontoon	Iron	—	—	82	—
2 Cattle barges ..	Steel	—	—	1378	—
1 Barge	,,	—	—	31	—
1 Screw Steamer ..	,,	—	—	50	24
1 Barge	,,	—	—	25	—
1 Screw Steamer ..	,,	—	—	68	9
1 ,, ,, ..	,,	—	—	16	5
1 Barge	Iron	Sail	—	111	—
40 Pontoons	,,	—	—	880	—
4 ,, ...	,,	—	—	56	—

By WM. SWAN & Co., Kelvin Dock, Maryhill, N.B.

* Victoria	Iron	Steam	Foreign	53	—

By RAMAGE & FERGUSON, Leith.

† Hailvong	Steel	Steam	British	1,252	300
† Red Eagle	,,	,,	,,	330	60
† Garland	,,	,,	,,	275	47
† Ancona	,,	,,	,,	1,245	120
† Ravenna	,,	,,	,,	1,245	120
† Maristow	,,	,,	,,	1,706	160

By ALEXANDER STEPHEN & SONS, Linthouse, Glasgow.

† Strathearn	Steel	Steam	British	2,995	250
† Domira	,,	,,	,,	1,881	170
† Baltimore City ..	,,	,,	,,	2,460	210
† Kentigern	,,	,,	,,	2,586	220
† Amaranth	,,	,,	,,	2,811	240
† Queen Elizabeth ..	,,	,,	,,	2,632	250

By HALL, RUSSELL & Co., Aberdeen.

† Choy-Sang ..	Steel	Steam	British	1,880	200
† Inanda	,,	,,	,,	1,759	220
* North Sea	,,	,,	,,	113	50
† Earl of Aberdeen ..	,,	,,	,,	730	180
* Cruiser	Wood	Yacht	,,	21	10

By THE GRANGEMOUTH DOCKYARD Co., Grangemouth.

* Britannia	Steel	Steam	British	123	60
† Sir Francis Drake ..	,,	,,	,,	1,741	160
† Ethel	,,	,,	,,	1,476	140
† Enrique Barozzo ..	,,	,,	Foreign	1,000	160
‡ Banks Peninsula ..	,,	,,	,,	216	216

By NAPIER, SHANKS & BELL, Yoker, Glasgow.

† Algonquin	Steel	Steam	British	1,806	150
† Islander	,,	,,	,,	1,496	280
† Ceto	,,	,,	,,	138	70
Foohng Suey ..	,,	Sail	Foreign	1,060	—
Empress	,,	Steam	British	229	60

By ROBERT DUNCAN & Co., Port Glasgow.

* Flying Cormorant ..	Steel	Steam	British	268	98
† Doris	,,	Screw	,,	1,785	120
† River Mersey ..	,,	,,	,,	1,785	120
Harold	,,	Sail	,,	1,376	—
Pass of Balmaha ..	,,	,,	,,	1,571	—

By A. & J. INGLIS, Pointhouse, Glasgow.

† Taroba	Steel	Screw	British	4,937	700
† Pundua	,,	,,	,,	3,304	400
† Purnea	,,	,,	,,	3,305	400
† Adriana	,,	,,	,,	307	60

By HAWTHORNS & Co., Leith.

* 51	Steel	Steam	British	340	250
* 62	,,	,,	,,	340	250
* May	Wood	,,	,,	10	6
* Tyne	,,	,,	,,	20	20

By JOHN REID & Co., Port Glasgow.

Three Sailing Vessels, one Screw Steamer. Gross registered tonnage, 5,260 tons.

* Compound. † Triple. ‡ High-pressure.

By the LONDON & GLASGOW SHIPBUILDING Co., Govan, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Flintshire	Steel	Steam	British	2,879	650
† Saikio Maru ..	,,	,,	Foreign	2,713	440
† Kobé Maru	,,	,,	,,	2,713	440
† Halifax	,,	,,	British	1,740	350

By A. HALL & Co., Footdee, Aberdeen.

† Lippe	Iron	Steam	Foreign	554	80
† Glaneuse	Steel	,,	,,	158	45
* Maggie Walker ..	Iron	,,	British	118	50
† Una	Steel	,,	Foreign	440	70

By S. M'KNIGHT & Co., Ayr.

* The Rose	Iron	Steam	British	241	130
* Alexandra	,,	,,	,,	142	80
† Tighnamara ..	Steel	,,	,,	141	45
† Dunmore	,,	,,	,,	1,282	117

By WM. HAMILTON & Co., Port Glasgow.

† Macassa	Steel	Steam	Foreign	460	100
† Orbo	,,	,,	British	1,822	180
Semantha	,,	Sail	,,	2,280	—

By SEATH & Co., Rutherglen, Glasgow.

Lucy Ashton	Steel	Steam	British	270	—
Cygnet	,,	,,	,,	40	—
Hindon	,,	,,	Foreign	60	—

By W. B. THOMPSON & Co., Limited, Dundee.

† Ibis	Steel	Steam	British	1,120	200
† Fulmar	,,	,,	,,	1,120	200
† Curfew	,,	,,	,,	1,950	200

By JOHN FULLERTON & Co., Paisley.

† Jacinth	Iron	Steam	British	518	80
* Wild Rose	,,	,,	,,	252	48
* Plover	,,	,,	,,	300	55

By AITKEN & MANSEL, Whiteinch, Glasgow.

† Lady Gordon ..	Steel	Steam	British	450	100
† Adirondack ..	,,	,,	,,	2,167	300
† Oanfa	,,	,,	,,	3,065	750

By PEARCE BROS., Dundee.

* Anshin-Maru ..	Iron	Steam	Foreign	304	60
† Duncan	Steel	,,	British	221	96

By GOURLAY BROS., Dundee.

† Gerona	Steel	Steam	British	3,100	420
† Ardle	,,	,,	,,	1,390	160

By SCOTT & Co., GREENOCK.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† Lady Weld	Steel	Steam	Foreign	511	800
‡ Sungkiang	,,	,,	,,	1,658	1,400
‡ Kaifong	,,	,,	,,	1,642	1,400
‡ Ulysses	,,	,,	,,	2,353	1,500
‡ Cabral	,,	,,	,,	753	650
* Stormlight	,,	,,	,,	88	100
* Meyun	,,	,,	,,	174	220

By W. SIMONS & Co., Renfrew.

† Trieste, C.	Steel	Steam	Foreign	200	1,200
† Abertay	,,	,,	British	1,100	850
* Excelsior, No. 1. ..	,,	,,	Foreign	35	80
* Excelsior, No. 2. ..	,,	,,	,,	35	80
* Aid	Iron	D'ger.	British	275	230
* Icicle	Steel	Steam	,,	60	90
* Barry	Iron	,,	,,	150	220
* Sode-ga-ura-maru	,,	,,	Foreign	330	250
* Haulbowline ..	,,	,,	British	375	250
* Otter	,,	,,	Colonial	550	500

* Compound. † Triple. ‡ High Pressure.

By Barclay Curle & Co., Limited, Whiteinch, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
† Wm. Cliff	Steel	Steam	British	3,500	2,500
† Darien	,,	,,	,,	3,500	2,500
† Benledi	,,	,,	,,	2,300	1,800
* Princess of Wales..	Iron	,,	,,	303	1,000

By John Scott & Co., Kinghorn, Fifeshire, N.B.

Clacton	Steel	Steam	British	250	850
* Mavis	,,	,,	,,	536	1,200
* Oriole	,,	,,	,,	443	1,450
† Epidauro	,,	,,	Foreign	342	500

By Fairfield Shipbuilding and Engineering Company, Limited, Govan, Glasgow.

H.M.S. Magicienne ..	Steel	Steam	British	2,960	—
H.M.S. Marathon ..	,,	,,	,,	2,960	—
Rouen	,,	,,	,,	761	3,700
Paris	,,	,,	,,	761	3,700
Lady Enfrida ..	,,	,,	,,	547	1,521
Chour Fa	,,	,,	,,	1,646	1,500
Stanley	,,	,,	Foreign	914	2,500
Dresden	,,	,,	,,	4,750	3,000

By Lobnitz & Co., Slip Dock, Renfrew, N.B.

Neficha Hop. Barge..	Iron	Steam	Foreign	400	300
* Nil ,,	,,	,,	,,	400	300
* Pharaon ,,	,,	,,	,,	400	300
* Philai ,,	,,	,,	,,	400	300
* Ramleh ,,	,,	,,	,,	400	300
* Rosette ,,	,,	,,	,,	400	300
* Sakkarah ,,	,,	,,	,,	400	300
* Sane ,,	,,	,,	,,	400	300
* Sinai ,,	,,	,,	,,	400	300
* Zagazig ,,	,,	,,	,,	400	300
* Chaloupe XXXVI.	Steel	,,	,,	40	65
* Chaloupe XXXVII.	,,	,,	,,	40	65
* Chaloupe XXXVIII.	,,	,,	,,	40	65
*Four Lighters (shipped in pieces)	Iron	Sail	,,	244	—

By Wm. Denny & Bros., Leven Shipyard, Dumbarton.

Princess Henrietta ..	—	Steam	Foreign	1,101	6,000
Lindula	—	,,	British	3,346	2,300
Ruby	—	,,	,,	32	75
Alfonso XIII. ..	—	,,	Foreign	4,600	5,500
Reina Maria Cristina	—	,,	,,	4,600	5,500
Princess Josephine ...	—	,,	,,	1,119	6,000
Zeus	—	Sail	,,	227	—
Poseidon	—	,,	,,	227	—
Artemisa	—	,,	,,	227	—
Hermes	—	,,	,,	227	—
Syriam	—	Steam	,,	300	650
Naikban	—	,,	,,	300	650
12 Flats (in pieces) ..	—	—	Various	7,116	—
14 Steamers ,, ..	—	—	,,	6,721	10,305

By Fleming & Ferguson, Paisley.

Skeandhu	—	Steam	British	80	200
Velez Sarsfield ..	—	,,	,,	600	800
* Ribble	—	,,	,,	800	900
Singapore	—	,,	Foreign	1,500	1,800

By Charles Connel & Co., Whiteinch, Glasgow.

Olymp	Steel	Sail	Foreign	1,663	—
Klio	,,	,,	,,	1,663	—
Kalliope	,,	,,	,,	1,664	—
† Traveller	,,	Steam	British	3,041	1,750
† Glenelg	,,	,,	,,	2,469	1,500
† Ramon de Larrinaga	,,	,,	Foreign	3,300	1,850

By Caird & Co., Greenock.

† Peninsular	Steel	Steam	British	4,972	5,000
† Oriental	,,	,,	,,	4,972	5,000

* Compound. † Triple.

J. M'Arthur & Co., Abbotswich, Paisley.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† Brunner	Steel	Steam	Colonial	541	750
Fusilier	Iron	Paddle	British	252	900
—	Steel	,,	,,	265	300
—	,,	,,	,,	265	300
—	,,	,,	,,	265	300
—	Iron	Pont'n	Colonial	12	—
* Tara Rota	Steel	Screw	British	3	10
—	,,	,,	,,	26	70

By D. & W. Henderson & Co., Meadowside Partick, Glasgow.

Princess Louise ..	Steel	Steam	British	817	960
Anglia	,,	,,	,,	3,288	2,100
Bellucia	,,	,,	,,	2,716	1,475
Milton..	,,	,,	,,	2,716	1,475
Bellarden	,,	,,	,,	2,716	1,475
Marion Lightbody ..	,,	Sail	,,	2,716	—
Yarana	Composite	Yacht	,,	46	—

By W. S. Cumming, Blackhill Dock, Glasgow.

* Luath	Steel	Steam	British	32	55
† Lucille	,,	,,	,,	48	100
No. 9	,,	,,	,,	14	40
——— ..	,,	Sail	Foreign	27	—
——— ..	,,	,,	,,	27	—
† ——— ..	Composite	Steam	,,	40	145
† ——— ..	Steel	Sail	,,	37	—

By J. Scott & Co., Kirkcaldy.

* Clacton	Steel	Steam	British	250	850
* Mavis	,,	,,	,,	410	1,200
* Oriole	,,	,,	,,	450	1,450
† Epidamo	,,	Screw	Foreign	345	500

By Scott & Co., Bowling, Glasgow.

† Ruby	Iron	Steam	British	461	829
* Loch Gair	,,	,,	,,	77	95
† Amadeo	Steel	,,	Foreign	76	214
* Spider	Iron	,,	British	130	250

By Murdoch & Murray, Port Glasgow.

* Chaseley	Steel	Steam	British	433	400
† Lochiel	,,	,,	,,	2,162	1,200
† Baron Douglas ..	,,	,,	,,	2,700	1,100

By R. Napier & Sons, Lancefield, Glasgow.

† Amber	Steel	Steam	British	1,034	1,550
† Biobio	,,	,,	Foreign	715	750
† Atrato	,,	,,	British	5,300	6,000

By Aberdorn Shipbuilding Company, Paisley.

† Torpedo Boat ..	Steel	Steam	British	85	1,000

By James & George Thomson, Clyde Bank, Glasgow.

† City of New York..	Steel	Steam	British	10,500	18,000
† City of Paris ..	,,	,,	,,	10,500	18,000

By David J. Dunlop & Co., Port Glasgow.

Leon and Castillo ..	Steel	Steam	British	550	800
Viera y Clavifo ..	,,	,,	,,	550	800
— ..	,,	,,	,,	400	—

By Ailsa Shipbuilding Co., Troon.

† Lady Ailsa.. ..	Steel	S.S.	British	1,270	700
‡ Kistna	,,	,,	,,	1,150	1,800
† Vreda	,,	Yacht	,,	20	—
† Maloom	,,	,,	,,	60	200
† Winstanley ..	,,	S.S.	,,	370	500

By A. M'Millan & Son, Dumbarton.

† Conscript	Composite	Steam	British	760	820
† Volunteer	,,	,,	,,	760	820
† Cayor	Steel	,,	Foreign	1,494	1,200
† Conquistator ..	,,	,,	,,	1,372	880
† Cometa	,,	,,	British	1,151	800
† Zuria	,,	,,	,,	2,200	1,100

* Compound. † Triple. ‡ High Pressure.

By Ardrossan Shipbuilding Co., Ardrossan, N.B.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Moss, Rose	Wood	Sail	British	161	—
† Ormea Yacht ..	Steel	Steam	,,	350	650

By John Cran & Co., Shipbuilders, Leith.

* Petrel	Iron	Steam	British	40	35
* Rollo	,,	,,	,,	,,	,,

By Alexander Stephen & Sons, Dundee.

Eudora	Steel	Sail	British	1,992	—

By Foster & Co., Dysart, N.B.

Restless	Wood	Sail	British	81	—

IRISH.

By Workman, Clark & Co., Limited, Belfast.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† City of Dublin ..	Steel	Steam	British	3,267	350
† Macgregor	,,	,,	,,	1,048	180
Caisson	Iron	—	,,	558	—
Caisson	,,	—	,,	558	—
Lorton	Steel	Sail	,,	1,420	—
Caisson	Iron	—	,,	276	—
Caisson	,,	—	,,	276	—
† Fort William ..	Steel	Steam	,,	1,807	136
† Kirklands	,,	,,	,,	1,807	136
† Lady Martin ..	,,	,,	,,	1,245	220
No. 3 Ferry	,,	,,	,,	13	9

By Harland & Wolff, Limited, Queen's Island, Belfast.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H. P. I.
Holkar	Steel	Sail	British	3,072	—
† Idar	,,	Steam	,,	4,050	2,300
† Bostonian	,,	,,	,,	4,473	2,500
† Cufic	,,	,,	,,	4,639	2,600
† Palmas	,,	,,	,,	2,428	1,200
† Lord Londonderry .	,,	,,	,,	2,450	1,200

By Chas. J. Bigger, Londonderry, Ireland.

No. 7 Horizon ..	Iron	Sail	Foreign	1,078	—
* ,, 8 Oporto ..	Steel	Steam	British	740	800
† ,, 9 Ivy	,,	,,	,,	531	1000
,, Cupica ..	,,	Sail	,,	1,232	—
,, Paul Isenberg	,,	,,	Foreign	1,232	—

By M'Illwaine & Lewis, Limited, Belfast.

Barge	Iron	—	British	—	—
† Titanic	Steel	Steam	,,	1,608	1,000
† Antrim	,,	,,	,,	450	700

AUSTRIAN.

By Stabilmento Tecnico, Trieste.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Jenny	Steel	Steam	Foreign	133	40
† Matilde	,,	,,	,,	100	40
† Dinara	,,	,,	,,	133	40
* Santorio	,,	,,	Austrian	133	40
† Tender	,,	,,	,,	97	40
† ,, ...	Wood	,,	,,	40	40

* Compound. † Triple.

BELGIUM.

By the Société Cockerill, Hoboken, Antwerp.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Congo	Steel	Steam	Belgium	1,736	750
La Flandre	,,	,,	,,	797	3,700
Ville de Gand ..	,,	,,	,,	—	280
Ville de Gand ..	,,	,,	Foreign	—	60
Ville de Liege ..	,,	,,	,,	—	60
Screw Tug	,,	,,	,,	—	120
Three Barges ..	,,	,,	Belgium	300	—
One Barge	Iron	Iron	Foreign	294	—
One Barge	,,	,,	,,	134	—

Sixteen Pontoons for the Portuguese Government. Wooden Pontoon for the Congo. Steel-built Boat for the Congo. Five Iron Screw Steamboats.

DANISH.

By Elsinore Iron Shipbuilding & Engineering Co., Elsinore.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
* Gefle	Steel	Steam	German	610	480
† Hafina	,,	,,	Danish	1,638	650

By Burmeister & Wain, Royal Dockyard, Copenhagen.

† Leopold II. ..	Steel	Steam	Danish	1,618	150
† Giorgios I. ..	,,	,,	,,	1,617	150

DUTCH.

By Conde Maas, Delaashavan, near Rotterdam.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Nederland	Steel	Steam	Dutch	265	62
† Dolfijn	,,	,,	,,	234	65

By Roninklyke Maatschappy de Schelde, Flushing, Holland.

† Bromo	Steel	Steam	Dutch	2,507	300
† Cerberus	,,	,,	,,	34	100
* Buijskes	,,	,,	,,	40	60
Biva	,,	Sail	,,	5	—

FINLAND.

By Wm. Crichton & Co., Aktiebolag, Abo, Finland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Ebba Munck ..	Steel	Steam	Finland	195	80
† Hebe	,,	,,	,,	170	80
† Relandersgrund ..	Iron	Ltship	,,	130	—
§ Toimi	,,	Steam	,,	20	8
* Pomor	Steel	,,	Foreign	50	40
* Belomor	,,	,,	,,	50	40
§ Volkoff	,,	,,	,,	20	10
§ Beresin	,,	,,	,,	25	20
§ Satawa	Wood	,,	Finland	—	6
§ Sylfid	,,	,,	,,	—	6
* Tjaika	Steel	,,	Foreign	—	8
* Two torpedo launches	,,	,,	,,	30	60
* Steam ferry ..	Iron	,,	Finland	45	10
§ Helmi	Wood	,,	,,	—	6
§ Postipoika ..	,,	,,	,,	—	3
§ Toimi	,,	,,	,,	—	3
§ ——	,,	,,	,,	—	3

* Compound. † Triple. § Single.

FRENCH.

By La Cie Des Messageries Maritimes, La Ciotat.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Guadalquiver ..	Iron	Steam	French	2,612	350
† Guadiana	,,	,,	,,	2,565	350
† Plata	,,	,,	,,	5,660	900
† Brisil	,,	,,	,,	5,660	900
† Dordogne	,,	,,	,,	4,200	400

By La Ste Anonyme Des Chantiers et Ateliers De La Gironde, Bordeaux.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
* Troude	Steel	Steam	French	977	6,060

By the L'Anonyme Des Chantiers et Ateliers De La Loire, St. Mazane.

* Paraguay	Iron	Steam	French	2,653	1,900

GERMAN.

By Flensburger, Schiffsbau Gesellschaft Flensburg.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Valeria	Steel	Steam	German	2,020	320
† Elsa	,,	,,	,,	785	80
† Gemma	,,	,,	,,	832	95
‡ Helene	,,	,,	,,	786	80
† Wartburg	,,	,,	,,	1,744	290
† Aglaia	,,	,,	,,	2,362	400
† Helene Sauber ..	,,	,,	,,	988	150

By Reiherstieg, Schiffswerfte und Maschinenfabrik, Hamburg.

† Belgrano	Steel	Steam	German	2,578	350
† San Nicholas ..	,,	,,	,,	2,601	250
† Flandria	,,	,,	,,	2,100	260

By Schiffswerft von Henry Koch, Lübeck.

* Hercules	Iron	Steam	German	594	60
* Ohrt	Steel	,,	,,	36	15
† Cintra	Iron	,,	,,	1,144	100
Barge	—	—	,,	—	—

By George Howaldt, Kiel.

* Hermann	Steel	Steam	German	51	30
* Boetticher	,,	,,	,,	54	20
* Maybach	,,	,,	,,	54	20
* Thea	,,	,,	,,	360	40
* Adolfs	,,	,,	Foreign	8	8
† Alsen	,,	,,	German	741	100
† Fehmarn	,,	,,	,,	739	100
† Sylt	,,	,,	,,	742	100
† Föhr	,,	,,	,,	744	100
† Fiume	,,	,,	Foreign	367	100
† Marstrand	,,	,,	,,	350	90
† Sumatra	,,	,,	German	560	90
* Siegfried	,,	,,	,,	80	85
* —	,,	,,	Foreign	175	35
Five pontoons ..	Iron	Sail	German	520	—
Barge	,,	,,	,,	57	—

By Gebruder Sachsenberg, Rosslau, Elbe.

† Niederrhein I. ..	Iron	Steam	German	470	800
* Fulda	,,	,,	,,	120	250
* Johann Faber VI...	,,	,,	,,	470	800
* Vereinigte Schiffer	,,	,,	,,	40	110
† Johann Faber VII.	,,	,,	,,	65	130
‡ Brasilien	,,	,,	Foreign	—	—
* Alexander Rosing..	,,	,,	German	410	200
Bremen No. 22 ..	Steel	Sail	,,	300	—
Bremen No. 23 ..	,,	,,	,,	300	—
Jonathan Siebert I. ..	Iron	,,	,,	700	—
Pontoons, 30 pieces ..	,,	—	,,	10	—
Dredger	,,	—	,,	20	15
Dredger-skute No. VIII	,,	Sail	,,	28	—

* Compound. † Triple. ‡ High Pressure.

By Actien Gesellschaft "Weser," Bremen.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
† Tagd	Steel	Steam	German	1,500	4,000
* D. III.	,,	,,	,,	280	80
* D. IV.	,,	,,	,,	280	80
* D. V.	,,	,,	,,	280	80
* D. VI.	,,	,,	,,	280	80
* D. VII.	,,	,,	,,	280	80
* D. VIII.	,,	,,	,,	280	80
* —	,,	Tug	,,	20	40
* Centaur	Iron	,,	,,	220	300
* Bagger A II. ..	,,	Ddgr.	,,	240	70
* Bagger A III. ..	,,	,,	,,	240	70
No. 274—385.. ..	Steel	B'rges	,,	1,200	—
No. 286—291.. ..	Iron	,,	,,	276	—

By Bremer Schiffsbaugesellschaft, Vegesack.

* Ost	Steel	Steam	German	32	70
* West	,,	,,	,,	32	70
* D. 13	,,	,,	,,	86	100
* D. 14	,,	,,	,,	86	100
Neck	Iron	Sail	,,	1,500	—
No. 1 No. 16	Steel	B'rges	,,	21	—
,, 21 ,, 22					
,, 23 ,, 24					
,, 25 ,, 26					

By Schiff und Maschinenbau, Actien Gesellschaft, Germania, Kiel.

Tug-boat	Steel	Steam	German	15	45
Torpedo-boat.. ..	,,	,,	Foreign	—	1,200
,, ...	,,	,,	,,	—	1,200
,, ...	,,	,,	,,	—	1,200
,, ...	,,	,,	,,	—	1,200

NORWAY.

By the Laxevaag's Shipbuilding & Engineering Co., Bergen.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Alden	Iron	Steam	Norway	433	80
† Nicolaus	,,	,,	,,	2,089	150
* Rolf (lengthened) ..	,,	,,	,,	—	11

The Use of Oil on the Sea.—Mr. T. M. Macknight, master of the screw steamer *Alps*, belonging to the Atlas Steamship Company, thus gives his experience as to the use of oil in bad weather at sea:—"On my last voyage across from Norfolk (Va.), I encountered a heavy gale from the W.S.W., lasting from October 25 to 29. At times the sea was very heavy, and I decided to run with oil. Having no fish oil at my disposal, the question arose what was the best substitute. After some trials I made a mixture of one part coal tar, three parts engine oil, and three parts mineral sperm. This was put in the forward privies, the pipes of which had been previously lightly stuffed with oakum. In addition, as we ran with the wind on our starboard quarter, a canvas bag half full of oakum was partially filled with the mixture of oils, and hung from the weather fish-davit, so as to dip in the water as she rolled. During the whole time that oil was used the ship absolutely took no water on board, and the seas coming up astern appeared to lose their force when they came to the oil. My deductions from this, and my previous experience is, that it is useless to apply oil to the after part of the ship; that even going before a gale at 11 or 12 knots, oil will prevent the shipping of dangerous seas even if it does not prevent them *in toto*; that a proper mixture of oils usually supplied to steamers is sufficient, and that it is not necessary for the master of a vessel to refrain from trying the experiment because he cannot get fish oil. In conclusion, I hope the day will come when all owners will see the use of oil, and acknowledge it, for much valuable property is yearly saved by those who believe in the use of oil." On a previous occasion, in 1886, Captain Macknight used oil with success in a gale whilst crossing the Gulf Stream, 100 miles E. of Cape Hatteras.

* Compound. † Triple.

SIR WILLIAM PEARCE, BART, M.P.

THE death of this eminent shipbuilder and useful Member of Parliament took place, on the morning of the 18th ult., at his London residence, 119, Piccadilly, where for more than three weeks he had been prostrated, suffering from cardiac affection of the heart. The deceased baronet, as is well known, was the managing director of the gigantic shipbuilding concern carried on by the Fairfield Shipbuilding and Engineering Company (Limited), Govan, formerly Messrs. John Elder & Co. Mr. Pearce joined the firm as a partner in 1869, shortly after the death of Mr. John Elder, and up till about four years ago exercised personal and practical oversight in the gigantic establishment at Fairfield. In 1885, however, he sought parliamentary honours and contested the Govan division of Lanarkshire in the Conservative interests, and was returned by a substantial majority. On the occasion of Her Majesty's Jubilee he was one of those chosen, for their distinguished services, to receive the honour of Baronetcy.

Sir William Pearce was born at Brompton, Kent, in 1833, and was thus at his death in his fifty-sixth year. Considering the great amount of important work he had achieved, and the proud eminence to which he had risen, the comparative youthfulness of the deceased baronet is notable. He was the son of Mr. Joseph George Pearce of Brompton, and early in life was entered as an Admiralty apprentice in Chatham Dockyard, where, in addition to his practical training as a shipwright, he was privileged to serve in the office of the late Oliver Lang, the then master shipwright. When the Government in 1861 resolved on the construction of warships in the Royal Dockyard, the first vessel laid down—the *Achilles*—was constructed under Mr. Pearce's superintendence in Chatham Dockyard. Not satisfied with the slow promotion in the Government service, he accepted an appointment to become one of the surveyors in Lloyd's Registry of Shipping. He was stationed on the Glasgow district, but had only been there one year when he was appointed shipyard manager to the celebrated firm of Messrs. Robert Napier & Sons, Govan. Under his superintendence many notable vessels were produced by Messrs. Napier, and two sister steamships of Mr. Pearce's own design, the *Periere* and the *Ville de Paris*, built for the Compagnie Générale Transatlantique, attained in actual service a high reputation for their swiftness. In 1869, as has been stated, he joined the firm of John Elder and Co., his co-partners then being Messrs. John Ure and John L. K. Jamieson. Both these gentlemen retired from the firm in 1878, and Mr. Pearce was left sole partner, and under his energetic, courageous, and able administration, the reputation of the old-established business for high-class work was maintained and strengthened. During the period of his connection with the firm, as much as 450,000 tons of shipping was produced, and it need scarcely be pointed out that the bulk of the work consisted of high-class, splendidly appointed, mail and passenger steamships for the Atlantic and other important ocean services. Perhaps no other man has done so much to extend and strengthen the name and fame of Clyde-built ships, and one has only to repeat the names, *Arizona*, *Alaska*, *Oregon*, *Etruria*, and *Umbria*, to appreciate the truth of this. The success of the Fairfield productions has been indeed marvellous, but the deceased Sir William was by no means complacently satisfied with this. He publicly maintained the feasibility of crossing the Atlantic in five days, and in the recent Glasgow Exhibition he exhibited a model of a twin-screw steamship, designed to accomplish the passage from Queenstown to New York in five days. The names of Fairfield and Mr. Pearce, besides being closely associated with the production of typical transatlantic liners, are also linked with that of swift channel paddle-steamers, light-draught river boats, and with that most sensational production the Czar of Russia's yacht *Livadia*, now seemingly relegated to the limbo of forgotten things. Much important work was also accomplished for the Government by Mr. Pearce, and it was with the view of enabling him to be entrusted with work of this kind that he converted his firm into a Limited Liability Company, shortly after he had been returned to Parliament. This was at the time of great trade depression, and the step was hailed with satisfaction by the workpeople, and was afterwards fully justified by the orders which the Admiralty entrusted to the company. But Mr. Pearce's attention and powers were all along bestowed upon more than shipbuilding matters. He projected or was largely interested in several lines of steamers, amongst others, the Guion Line, the Pacific Mail Steamship Co., the New Zealand Shipping Co., and the Scottish Oriental Steamship Co., of which latter company he was chairman. He was a member of Council of the Institute of Naval Architects, a member of the Iron and Steel Institute, and of the Institution of Engineers and Shipbuilders in Scotland, but took very little part in the proceedings of these societies. On the other hand his great experience and keen powers of perception were requisitioned in the many Royal Commissions on which he was appointed to serve:—The Commission on Tonnage, in 1881, on Saving Life at Sea, 1884, on Pilotage, and on the Commission which sat last year on the Navy Estimates.

A keen sense of loss has been excited by Sir William's decease amongst the Fairfield workmen, and, indeed, the whole community of Govan, by whom his powers as a leader of industry, and his considerateness as an employer were gratefully recognised. He leaves a widow and one son, a member of the English Bar, who will inherit his father's title.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from November 24th to December 21st, 1888:—

Adams, John H., chief engineer to the *Indus*, additional, for service at Devonport Dockyard as acting second assistant to chief engineer, to date December 11th.

Ash, Harold E. H., assistant engineer to the *Severn*, to date November 27th.

Austin, Frederick W., acting engineer to the *Melpomene*, to date December 21st.

Bedbrook, James E., fleet engineer to the *Indus*, additional, to date December 3rd.

Booth, John W., assistant engineer to the *Champion*, to date December 4th.

Corner, John T., staff engineer to the *Asia*, additional, for Portsmouth Dockyard, to date December 11th.

Edmonds, James C., engineer to the *President*, additional, for temporary service at the Admiralty, to date December 7th.

Ellis, Jos. H. W. H., engineer to the *Pembroke*, additional, to date December 3rd.

Flood, Frederick J., engineer to the *Magpie*, to date December 21.

Gibbs, Alfred W., engineer to the *Vernon*, additional, to date December 3rd.

Goodbeer, Samuel, assistant engineer to the *Anson*, to date November 26th.

Goodwin, George G., engineer to the *President*, additional, for temporary service at the Admiralty, to date December 7th.

Jenkins, J. E., engineer to the *Camperdown*, to date November 26th.

King, Quenton W., engineer to the *Partridge*, to date December 12th.

Lawson, William R., (probationary) to the *Champion*, to date December 4th.

Lawton, William A., (probationary) assistant engineer to the *Pembroke*, supernumerary, to date December 14th.

Mayson, Robert, additional, for Portsmouth Dockyard, as first assistant to chief engineer, to date December 11th.

Parker, W. R., assistant engineer, additional, to the *Pembroke*, to date December 21st.

Parsons, George, chief engineer to the *Champion*, to date December 4th.

Pattison, Alfred J., assistant engineer to the *Hibernia*.

Rees, John S., engineer to the *Rambler*, undated.

Rudd, Charles, chief engineer to the *President*, additional, for service at the Admiralty, to date December 11th.

Shorey, Charles E., assistant engineer to the *Polyphemus*.

Seroombe, Francis J., assistant engineer to the *Crocodile*, to date November 26th.

Thompson, Jos. H., acting assistant engineer to the *Témeraire*.

Trench, Richard J. C., chief engineer to the *Asia*, additional, to date December 20th.

Vaughan, John A., acting assistant engineer to the *Champion*, to date December 4th.

Watkins, Benjamin J., assistant engineer to the *Tartar*.

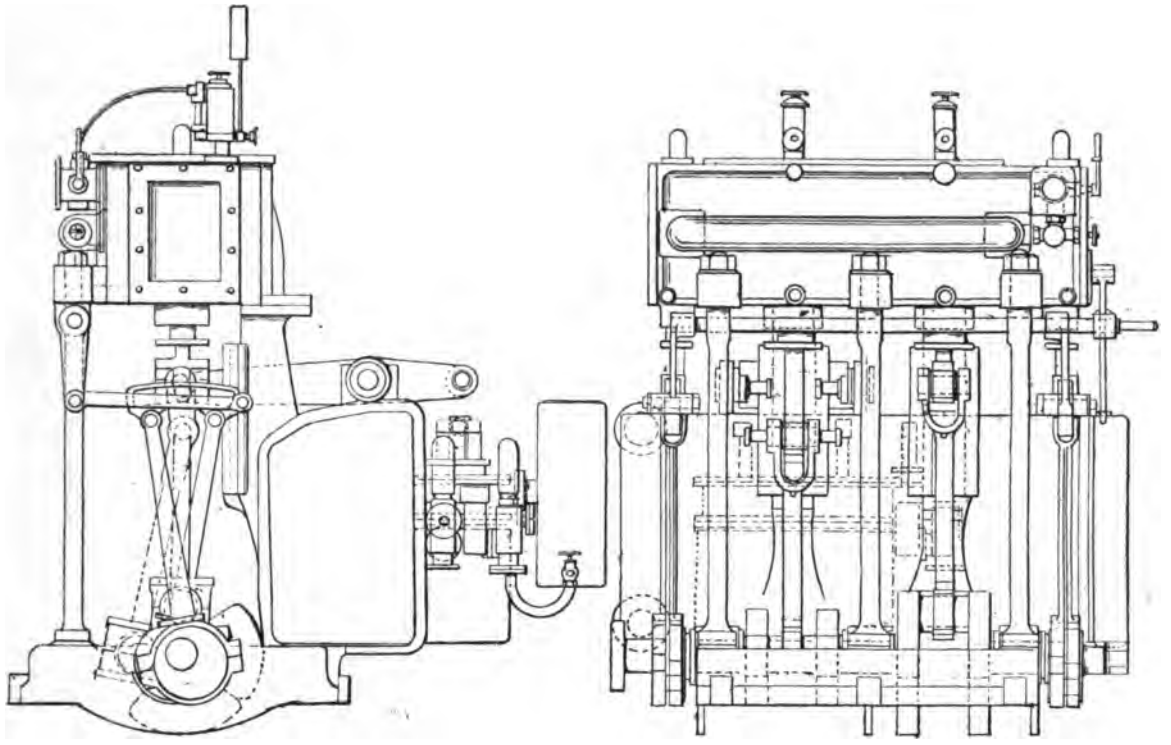
Webster, George P., assistant engineer to the *Rambler*, undated.

Weeks, Edward J. (probationary), assistant engineer to the *Anson*, to date December 8th.

Wishart, William L., additional, for Portsmouth Dockyard as second assistant to chief engineer, to date December 11th.

THE "THAMES CHURCH MISSION" STEAM LAUNCH, THE "EDWARD AURIOL."

THE launch under notice is intended for the purpose of visiting various vessels between the port of London and Gravesend, etc., and capable of running further distances; and we had the pleasure in attending the trial trip on the 3rd ult., prior to which it had been officially dedicated in the beneficial interests intended by the Right Rev. The Bishop of London, aided by the Rev. H. Bloomer, Clerical Superintendent of the Mission, in the presence of a very large and influential assemblage interested in such a deserving cause for which it is designed.



FIGS. 3 & 4.

END AND FRONT ELEVATION OF COMPOUND SURFACE-CONDENSING ENGINES OF THE "EDWARD AURIOL," CONSTRUCTED BY MESSRS. EDWARD CLARK & CO., OF STROUD, GLOUCESTERSHIRE, FOR THE "THAMES CHURCH MISSION."

We have, therefore, much pleasure in submitting to our readers illustrations in connection with the same. Figures 1 and 2, page 346, showing respectively a longitudinal section and deck plan of the vessel; Figures 3 and 4, page 345, likewise exhibiting both side and front elevations of the compound engines and working gear. The vessel is built exceptionally strong for the purpose throughout with Landore Siemens steel by Messrs. Edward Clark & Co., of Stroud, Gloucestershire, Naval Architects and Engineers, who also constructed the machinery. Her dimensions are as follows:—Length over all, 51 ft.; beam, 10 ft.; depth below decks, 5½ ft.; height of bulkheads, 1½ ft. The keel is formed of bar iron, 4 in. by 1 in. The frames are spaced 1 ft. 6 in., and continuous in section, are 2 in. by 2 in. by 5-16th in., with reverse frames.

The plating of the vessel is ¼ in. thick, bilge stringers double, 2½ in. by 2 in. by 5-16th in., and sheer stringers 12 in. by ¼ in. The decks are of teak, 2 in. thick. The cabin lights being formed by a continuous steel combing, having scuttle lights in sides, and covered with double-decking and companion hatches thereon.

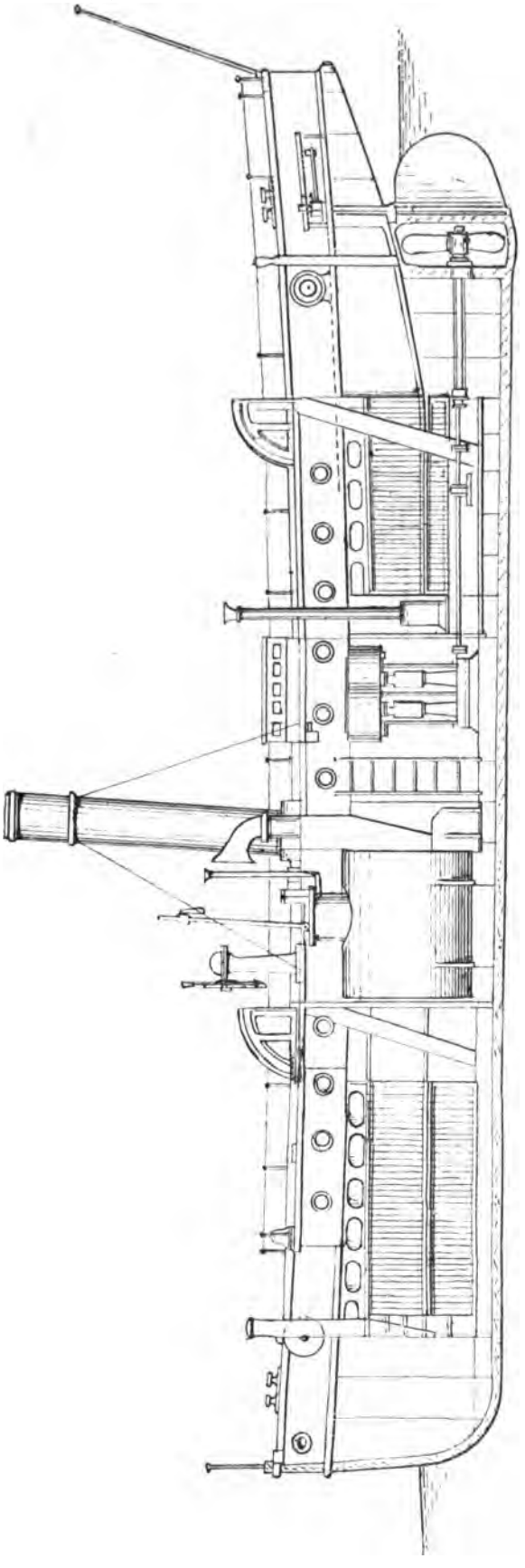
The machinery consists of a return tube boiler, 4 ft. 6 in. diameter by 5 ft. 6 in. long, tubes 2½ in. diameter and 54 in number, giving a heating surface of 165 square feet and a grate area of 6 ft. The engines are compound surface-condensing, of a very neat and compact design. The cylinders are of 7 in. and 13 in. diameter by 8 in. stroke, and are supported at back by columns with the condenser cast on same, and in front by three bright steel columns. The air and circulating pumps are 5 in. in diameter by 4 in. stroke, driven by lever and beams, and fitted with "Beldam's" Metallic Valves. The feed and bilge pumps are accessible by being both at one end and driven from the air-pump cross bar, and have 1¼ in. plungers. The condenser has 196 tubes of ⅝ in. brass, packed with brass ferrules screwed into the condenser plates. The crank shaft is of 2¾ in. diameter, turned from a solid forging throughout, with solid webs, eccentrics and couplings, with bearings 5½ in. wide and 2¾ in. diameter.

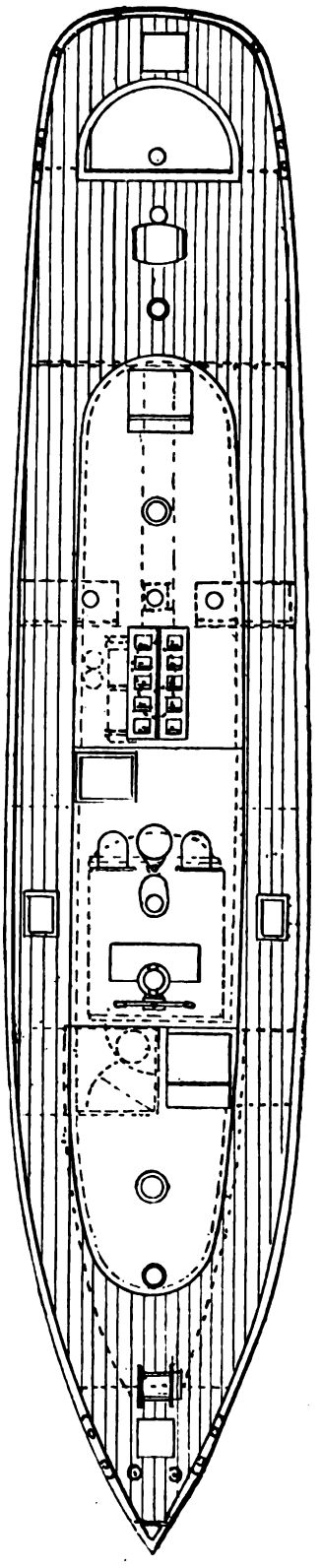
The starting gear is effected by the opening of an angular wheel valve leading into the low pressure steam-passage pipe, and appears certain in action.

The propeller is 3 ft. 6 in. in diameter by 5 ft. pitch, and the speed of the launch on the trial trip averaged fully 8 knots per hour, although under somewhat unfavourable circumstances, as in respect to fuel consumed, height of uptake, &c., and other contingencies, which, when remedied and otherwise favoured, would give better results if wished.

The engines worked satisfactorily at 100 lb. on the square inch, maintaining a good vacuum; and considerable attention appears to have been paid to their lubrication, a sight-feed lubricator being fitted to the steam-pipe, as well as to the tallow cups of the cylinders, and in fact all the bearings are fed by copper pipes leading from the main oil-box.

The launch was built under the survey of the Board of Trade also by the superintendence of J. J. Holdsworth, Esq., of London, and from the general character of the vessel in its construction, workmanship, and in its entirety throughout, reflects very great credit upon the builders, and will doubtless prove itself highly efficient for the very deserving and laudable purpose for which it is required and intended.





THE "THAMES CHURCH MISSION" STEAM LAUNCH, THE "EDWARD AURIOL."

BUILT BY MESSRS. EDWARD CLARK & CO., STROUD. (See page 345.)

FIGS. 1 & 2.

SHIPBUILDING AND ENGINEERING DURING 1888.

THE CLYDE AND SCOTLAND.

THE improvement in the shipbuilding, engineering and cognate industries of the Clyde, and other Scottish ports, which began to make itself felt in the autumn of 1887, has happily continued, and been increasingly strengthened during 1888, until now at its close, the shipyards and engine works, with but few exceptions, are taxed to their utmost, and the work on hand, or contracted for, will keep the firms employed for many months to come. The plethora of orders placed with the Clyde builders, as with those elsewhere, was not long in affecting the prices of material and the rate of wages. Early in the autumn the advance of shipbuilders' prices was most marked, and a comparative cessation of fresh contracts ensued. This was due, of course, to the cumulative demands of the shipyard operatives for higher wages, and to the great advance in steelmakers' prices, due in great part to the demands of their workmen. As illustrating this, it was proved that, within the period of a few weeks during autumn, the price of a well-equipped cargo steamer, with triple-expansion engines, advanced from £27,000 to £30,000. The advance in the price of steel, during little more than the same period, amounted to as much as 22 per cent. About October, therefore, the orders for new vessels were greatly diminished in number, and in some instances, vessels which were all but placed, were withdrawn from the market owing to the large price wanted. The few contracts now being placed are mostly for vessels required for specific trades, but rumours have been lately afloat regarding important new contracts for extensive shipping enterprises.

The work on hand is, as already indicated, sufficient to keep almost all the yards and engine shops employed for many months, and if the freight market in the immediate future prove in no worse condition than at present, when the tendency is towards lower rates homewards and higher rates outwards, the prospects of a continuance of orders being entrusted to shipbuilders are not by any means discouraging.

The Clyde.—In this, the principal centre of the shipbuilding industry in the kingdom, the amount of shipping produced is represented by 302 vessels, aggregating 280,037 tons, of which 175 were steamers with a tonnage of 228,850, and 127 were sailing ships of 51,187 tons. The output for the year previous consisted of 326 vessels, aggregating 185,362 tons, of which 203 were steamers of 147,537 tons, and 123 sailing ships of 37,525 tons. The output for 1888, therefore, is 94,675 tons in advance of that of the year previous, and is, indeed, the largest since 1884, when the total amounted to 296,854 tons. The following table, showing the exact tonnage returns for the last 30 years, will be found useful for purposes of comparison:—

1888	280,037	1873	232,926
1887	185,362	1872	230,347
1886	172,440	1871	196,229
1885	193,453	1870	180,401
1884	296,854	1869	192,310
1883	419,664	1868	169,571
1882	391,934	1867	108,024
1881	341,022	1866	124,513
1880	241,114	1865	153,932
1879	174,750	1864	178,505
1878	222,353	1863	123,262
1877	169,710	1862	69,967
1876	174,824	1861	66,801
1875	211,824	1860	47,833
1874	262,430	1859	35,709

The proportion, which the number of sailing ships bears to that of steamers, is about the same as in the past two years, but, as might have been expected, the proportion of steel built vessels to those built in iron, is an increasing figure. Practically, steel has now entirely superseded iron, for the main features in ship construction, such as frames, floors, beams, and shell plating, but for such parts as deck plating, bunker and tunnel plating, and the tops of water ballast bottoms, which are subject to corrosive and other wearing influences, and are structurally not of the first importance, iron is by preference still used, and that now to a greater extent than formerly. The extent to which steel has superseded iron as a structural material must therefore be discounted so far, and there is still a small foothold for the manufacture of the old material. Out of the 302 vessels built on the Clyde during 1888, as many as 238 representing 269,48 tons were of steel, leaving only 64 of about 10,550 tons constructed of iron and wood. Of iron vessels there were 52 of 8,718 tons. The following table shows how steady has been the progress in the adoption of the superior material:—

	Total tonnage.	Tonnage of steel vessels.	Percentage of steel to tot. ton.
1879	174,750	18,000	about 10½
1880	241,114	42,000	,, 17½
1881	341,022	66,609	,, 19½
1882	391,934	108,254	,, 27⅝
1883	419,664	129,651	,, 31
1884	296,854	133,670	,, 45
1885	193,458	92,677	,, 48
1886	172,440	116,932	,, 68½
1887	185,362	148,596	,, 80
1888	280,037	269,480	,, 96

The work of the past year has been fairly spread over the whole district of the Clyde and its estuary, and we give below a tabulated statement which exhibits clearly the extent to which the several firms have contributed to the grand total. The horse-power of engines in the table, it should be explained, is only given where the builders were also the engineers. A separate statement of the engines made by engineers who are not themselves builders will be afterwards given.

Builders.	Total No. of Vessels.	Tonnage of Sailing Ships.	Tonnage of Steamers.	Total Tonnage.	Horse-Power of Engines.
Messrs. Russell & Co.	23	22,957	22,538	45,495	—
Wm. Denny & Brothers	38	8,024	22,119	30,143	36,980
Jas. & Geo. Thomson	2	—	21,000	21,000	36,000
Alex. Stephens & Sons	7	1,660	15,315	16,975	7,700
Fairfield Company	8	—	15,299	15,299	15,720
D. & W. Henderson & Co.	7	2,222	12,253	14,475	7,485
Charles Connell & Co.	6	4,992	8,811	13,803	—
A. & J. Inglis	4	—	11,855	11,855	10,481
London & Glasgow Co.	4	—	10,045	10,045	—
Caird & Co.	2	—	9,944	9,944	10,000
Barclay, Curle & Co.	4	—	9,340	9,340	7,800
A. M'Millan & Son	6	—	7,737	7,737	—
Scott & Co., Greenock	7	—	7,179	7,179	6,070
R. Napier & Sons	3	—	7,047	7,047	8,300
R. Duncan & Co.	5	2,950	3,840	6,790	—
Aitken & Mansel	3	—	5,682	5,682	—
Murdoch & Murray	3	—	5,295	5,295	—
John Reid & Co.	4	—	5,200	5,200	—
Napier, Shanks & Bell	5	1,060	3,650	4,710	—
W. Hamilton & Co.	3	2,280	2,282	4,562	—
Lobnitz & Co.	17	—	4,364	4,364	3,195
Wm. Simons & Co.	10	—	3,110	3,110	3,750
Fleming & Ferguson	4	—	2,980	2,980	3,700
Ailsa Shipbuilding Co.	5	20	2,850	2,870	—
Alley & MacLellan	31	2,094	134	2,228	39
Birrell, Stenhouse & Co.	1	1,906	—	1,906	—
M'Knight & Co.	4	—	1,806	1,806	—
J. M'Arthur & Co.	8	12	1,617	1,629	—
Campbeltown Co.	1	—	1,508	1,508	—
D. J. Dunlop & Co.	3	400	1,100	1,500	1,600
John Fullerton & Co.	3	—	1,071	1,071	—
Scott & Co., Bowling	4	—	744	744	—
Ardrossan Shipbuilding Co.	2	161	350	511	—
T. B. Seath & Co.	3	40	350	390	—
Meehan & Sons	45	236	—	236	—
W. S. Cumming	7	91	134	225	340
D. M'Gill & Co.	1	—	165	165	—
Hanna, Donald & Wilson	1	—	83	83	1,000
Wm. Fyfe & Son	7	82	—	82	—
Wm. Swan & Son	1	53	—	53	—
Totals	302	51,240	228,797	280,037	160161

As a rule, the output of the separate firms during the past year is greatly in advance of that of the previous years, and we have to go back to the busy times of 1882-83 to find a parallel to the

figures representing the several firms' efforts during 1888. Messrs. Russell & Co., it will be seen, are at the top of the list, with an output of 23 vessels, aggregating 45,495 tons. This enterprising firm carry on three separate yards at Port Glasgow and Greenock. This is the fourth time they have occupied this distinguished position in the annual stocktaking in the Clyde shipbuilding industry. The past year's figures is 18,460 tons over their production of last year, 5,652 tons over that of 1886, 4,629 tons over 1885, 13,375 tons over 1884, 14,885 tons over 1883, and 24,832 tons over 1882; all the years previous being very much smaller than any of those given. The enormous business done by this firm during the year represents almost one-sixth of the total production from Clyde shipyards, and although they have three yards the work done represents a very satisfactory output from each. Of course the fact should be taken into account that the larger half of their output consisted of sailing ships and the other half of plain cargo-carrying steamers, and in view of the difference in the internal fittings, the tonnage, therefore, does not represent the same amount of labour as in the case of passenger-carrying vessels. Messrs. W. Denny & Bros. are second on the list with a total of 30,143 tons, an increase of 19,774 tons over last year, of 17,219 tons over 1886, of 13,720 tons over 1885, and of 6,127 tons over 1884. In 1882 and 1883 their output was about 22,000 tons each year, and in no preceding year was it greater, so that the work done by this firm this year is also in excess of anything they have hitherto accomplished. Third in order comes the firm of Messrs. James & George Thomson, Clydebank, who, while they have only completed two vessels, the *City of New York* and the *City of Paris* during the year, have a total tonnage of 21,000. Last year this firm completed three vessels amounting to 8,200 tons, so that, with a decrease of one vessel, they have an increase in tonnage of 12,800. In 1882 their tonnage was 21,300, and in 1881 27,100, but these are the only years in which their output exceeded the present.

We have not space, however, to further particularise the work of individual firms, and the reference to the *City of New York* and *City of Paris* suggests that we should now make some allusion to the most noteworthy of the vessels produced by the various firms. The largest, and, in other respects the most noteworthy vessels produced, were the *City of New York* and the *City of Paris* just referred to, each of 10,500 tons, with engines of 18,000 H.P., built for the Inman and International Steamship Company's Atlantic service. These, indeed, are the largest vessels afloat. Next in point of size is the *Atrato*, of 5,300 tons, with engines of 6,000 I.H.P., constructed by Messrs. Robt. Napier & Sons, Govan, for the Royal Mail Steam Packet Company's Brazilian service; the two P. & O. steamers *Peninsular* and *Oriental*, of 4,972 tons each, with engines of 5,000 I.H.P., built by Messrs. Caird & Co.; *Alfonso XII.* and *Reina Maria Cristina*, each of 4,600 tons, with engines of 5,500 I.H.P., constructed by Messrs. W. Denny & Brothers, Dumbarton, for the Compagnie Transatlantica of Barcelona, and the *Dresden*, a vessel of about 4,500 tons, built in the short space of 96 days by the Fairfield Company for the North German Lloyd. Sailing ships are year by year increasing in size, and the past year has again seen the production of the largest on record, the *Liverpool*, a vessel of 3,377 tons, built by Messrs. Russell & Co. for Messrs. G. W. Leyland & Co., Liverpool. Other noteworthy vessels produced by Messrs. Russell were the *Ocean* and *Charlies*, two steel steamers of 2,835 and 3,003 tons respectively, designed for carrying petroleum in bulk. These are the first vessels built for this purpose on the Clyde, and their construction necessitated the most careful workmanship. Other two vessels for the same firm—Hermann Stursburg & Co., New York—are at present building by Clyde firms.

The Clyde continues to secure a fair share of Government work. During the past year the Fairfield Company built two wood-sheathed deck-protected cruisers, 3,000 tons displacement, *Magicienne* and *Marathon*, the latter of which was named by H.R.H. Princess Beatrice. Messrs. Hanna, Donald & Wilson built and engined to the order of the Indian Government a first-class torpedo boat, which attained a high rate of speed on the measured mile; Messrs. R. Napier & Sons constructed two sets of triple-expansion engines for vessels of the Spanish Navy, while one or two small craft were built by other firms. Messrs. J. & G. Thomson, Clydebank, who have done a very large amount of Government work lately, have, in an early stage of construction, two first-class steel protective-deck cruisers for the Australian squadron, and a fast gunboat for the Japanese Government, while Messrs. Scott & Co., Greenock, have in an advanced state two gunboats for the British Admiralty.

Considered from the point of view of size and capacity, the past year's work on the Clyde, compared with the two previous years, yields the following. Of the vessels launched there were:—

	1888.	1887.	1886.
Under 50 tons.....	97	187	28
,, 100 ,, ...	18	18	13
,, 500 ,, ...	58	46	46
,, 1,000 ,, ...	34	10	14
,, 1,500 ,, ...	17	16	11
,, 2,000 ,, ...	22	16	24
,, 2,500 ,, ...	17	11	20
,, 3,000 ,, ...	17	10	2
,, 4,000 ,, ...	12	6	2
Above 4,000 tons....	9	6	6

As indicated by the tabular statement of the output of individual firms already given, the construction of engines by shipbuilding firms, who are themselves engineers, aggregated 160,161 I.H.P. A large number of engines, however, are yearly made by firms who do not build the ships. Indeed, many of the engineering firms, following a practice which is becoming yearly more common, booked orders for both hull and engines, and sub-contracted for the former. The engineers, who are not themselves shipbuilders, have turned out during the past year 179 sets of engines, aggregating 98,365 I.H.P. In a number of instances vessels which have been built elsewhere, have been towed into the Clyde and fitted with engines by Clyde engineers, or the engines have been dispatched to their destination by rail. The following is a tabular statement for the past year and the year previous of the marine engines made by firms who did not themselves build the ships in which they were fitted:—

	1888.		1887.	
	No. of Eng.	Ind. H.P.	No. of Eng.	Ind. H.P.
Messrs. J. & J. Thomson	7	14,100	6	10,200
Dunsmuir & Jackson	11	11,730	9	3,950
Hutson & Corbet.....	14	10,800	5	3,600
R. Napier & Sons	5	9,600	—	—
Jas. Howden & Co.....	6	7,600	4	6,850
Muir & Houston	12	6,725	3	4,450
David Rowan & Co.	3	6,170	5	7,460
Ross & Duncan	26	5,245	26	4,375
Wm. King & Co.....	4	4,040	1	700
Duncan, Stewart & Co.	3	4,000	2	2,450
Kincaid & Co.	2	4,000	3	800
Rankin & Blackmore	4	3,840	4	5,640
Bow & M'Lauchlan	18	2,790	—	—
Matthew Paul & Co.	47	2,735	—	—
Wm. Kemp	4	2,530	2	900
A. & J. Inglis	1	1,860	—	—
Fleming & Ferguson	12	600	—	—
Walker, Henderson & Co.	—	—	2	940
	179	98,365	72	52,315

Messrs. R. & W. Hawthorn, Leslie & Co., have also been very busy in their Dry Dock department. Some of the largest mail steamers afloat have been docked at Hebburn last year, and a large amount of repairing work has been done, including extensive damage and re-classification repairs and alterations.

Their Forge department has been also well employed during the year, the output of ship and engine forgings, for home and foreign markets, being very large.

Leith and Grangemouth.—These two ports on the Forth have done a creditable amount of shipbuilding during 1888. Here, as on the Clyde, the work on hand is considerable and the prospects encouraging. The vessels launched were of an aggregate tonnage of 6,100, being considerably in advance of the output of the past two years. Messrs. Ramage and Ferguson built six vessels of a total tonnage of 6,053, three of these being each 1,250 tons and one slightly over 1,700 tons. At present the firm has on the stocks one of the largest vessels ever built at this port. The other launches, which were small, included a couple of coaling tugs for the Admiralty, built by Messrs. Hawthorns & Co., and several barges built by Messrs. R. & H. Morton. Both of the latter firms supplied triple-expansion engines during the year to a number of local steamers. Messrs. Morton have booked orders for a couple of steamers to be finished early next year.

The Grangemouth Shipbuilding Company launched during the year five steamers of a total tonnage of 4,556, their engines collectively indicating 3,586 H.P. In 1887 they completed seven vessels of 1,730 tons, of which five were steamers, with engines aggregating 2,485 I.H.P.; in 1886 they constructed eight vessels of 2,627 tons, six being steamers, with engines of 2,164 I.H.P.; and in 1885 they launched seven vessels of 1,153 tons, three of which were steamers, with engines of 1,320 I.H.P. From these figures it will be seen that 1888's output is not only greatly in advance of previous years, but that the average tonnage of vessels built is considerably higher. Most of the company's steamers are engined by Glasgow engineers. The work on hand comprises seven steamers, aggregating 8,900 tons gross, three of which are 1,800 tons each. It will thus be seen that the company have their hands full, and proof of their determination to be equal to the occasion is had in the fact that one of the two shipyards established at Alloa, and for some time unoccupied, has been purchased by the company, and preparations made in it for resuming operations.

Alloa and Kirkcaldy.—As indicated above, the shipbuilding industry at Alloa has been practically at a standstill for some years past. Only one of the two yards here has been tenanted, but operations have been confined to the docking and repairing of vessels. With the advent of the Grangemouth Shipbuilding Company, however, in the other yard, a more active state of matters may be expected to ensue.

Messrs. D. Scott & Co., the shipbuilders of Kirkcaldy, have launched during 1888 four steel steamers of 1,455 tons in all, and with engines aggregating 4,000 I.H.P. During 1887 they completed six steamers aggregating 1,900 tons with engines indicating 5,230 H.P. Three of the vessels built during the past year were paddle steamers, for the London passenger trade, two being built to the order of the General Steam Navigation Co., London, and one for the London, Woolwich, and Clacton-on-Sea Steamboat Co. (Limited). Messrs. Scott & Co. have still three vessels on hand, two of them being for the General Steam Navigation Co., and of similar dimensions to the two already built.

Dundee.—The shipbuilders of Dundee have not, by any means, had their energies taxed severely during the year, and it is matter for surprise that with the undoubted facilities their establishments afford for the production of ships, they have had such limited share in the general "boom." It was not until the year was well advanced that the revival, elsewhere experienced, began to make itself felt at Dundee. This fact, therefore, and not the incapacity of its shipbuilders and their operatives, accounts for the comparative smallness of results. The combined output of the four shipyards amounts to eight vessels of a total tonnage of 11,197. In 1887 there were 15 vessels turned out, aggregating 14,245 tons, so that, notwithstanding the great advance in production elsewhere, there has been a falling off in both the number and tonnage of vessels built at this port.

While, however, the output for 1888 does not aggregate so much as might have been expected, and falls short of the total for 1887 by over 3,000 tons, it is gratifying to know that the work on hand at present exceeds in amount the whole of the past year's output. There are altogether 11 vessels under construction, representing an aggregate tonnage of 16,079. This state of activity, and the encouraging prospects for the future, form a marked contrast to the state of matters at the close of 1887, when only two vessels, representing a tonnage of 5,126, were on hand.

Messrs. Gourlay Brothers & Co. launched two vessels of the aggregate tonnage of 4,490, one of which was the *Gerona*, of 3,100 tons, for Messrs. Wm. Thomson & Sons, Dundee, and they have on hand four steamers whose combined tonnage is 4,490, two of them being for local owners. Messrs. W. B. Thompson & Co., Limited, completed three steamers of a total tonnage of 4,190, and they have on hand five steamers of 7,280 tons, including a large vessel of 3,350 tons for the Clyde Shipping Company. Messrs. Alex. Stephen & Sons only launched one—a sailing vessel, of 1,992 tons gross register, and that for their own firm—while at present they have orders on hand for two vessels, one a lightship for the Carr Rock, of wood, for the Government, and the other a steel and iron barque of 1,350 tons for Liverpool owners. Messrs. Pearce Brothers launched two vessels of an aggregate of 525 tons, but at present have no work on hand. This firm's yard has been offered for sale; but, although some inquiries have been made regarding it, no sale, so far as we have learned, has yet been made.

Marine engineering at Dundee has necessarily shared in the general improvement which has taken place in its shipbuilding during the year. The three firms engaged in this industry have finished 12 sets of engines with a combined N.H.P. of 1,770, while at present two firms have on hand, between them, 13 sets, aggregating 2,395 N.H.P. Messrs. Gourlay Bros. have finished three sets of a total of 850 H.P., besides converting the engines of the s.s. *Plover* into triple-expansion, and they have five sets of 1,015 H.P. in course of construction. Messrs. W. B. Thompson and Co., Limited, have constructed six sets of 795 H.P., and they have in hand eight sets of 1,380 H.P. At Lilybank Foundry (Messrs. Pearce Bros.) three sets have been completed of 106 H.P., and at the Britannia Works (Messrs. Whyte & Cooper) three sets have been compounded, and there is being constructed a pair of steel boilers for the s.s. *Glenisla*, 150 H.P.

Aberdeen.—This port has, throughout the year, shared in the general improvement, which set in about the end of 1887, and the year closes with a gratifying amount of work on hand. During the year nine vessels have been launched, representing a total tonnage of 6,640, a very considerable improvement on the output for 1887, which, although consisting of six vessels, only aggregated 1,882 tons. The vessels presently on the stocks number nine, having a total tonnage of 9,110, as against four vessels with a tonnage of 5,114 building at the close of 1887. The industry is therefore in a more flourishing condition at present than at any previous time since the great boom of 1882-83. Messrs. Hall, Russell & Co., of the three firms established here, have done the largest amount of work. They have built and engined four steel steamers of an aggregate tonnage of 4,570, and in addition to other repairing work, have refitted two steamers with triple-expansion engines. The firm have on hand three steamers, each of about 1,800 tons, and two steam trawlers, and they are at present engaged in converting the engines of the s.s. *Glenfalloch*, of Glasgow, to the triple-expansion system. Messrs. A. Hall and Co. also launched four vessels during the year, but of very moderate dimensions, the total tonnage amounting to 1,270 tons gross. They have also done a good deal of repairing work in the graving dock. They have at present on hand three vessels, a large sailing ship, a steel steamer, and a steel steam trawler. Messrs. John Duthie, Sons & Co. launched during the year an iron steamer of 800 tons, and have another on hand.

It may be interesting and of service if, in concluding, we tabulate the total production in the several localities. The figures for 1888, together with those for the five previous years, are accordingly appended:—

	1888.	1887.	1886.	1885.	1884.	1883.
Clyde ..	280,037	185,362	172,440	193,453	296,854	419,654
Dundee ..	11,197	14,246	3,347	7,358	12,071	25,276
Leith ..	6,000	4,167	5,340	7,769	5,000	13,722
Aberdeen ..	6,640	1,842	1,550	6,246	7,626	11,628
Grangemouth	4,556	1,730	2,627	1,153	1,563	4,332
Kirkcaldy ..	1,455	1,920	—	—	—	—

HER MAJESTY'S SHIP "MEDEA."

ON Thursday, December 20th, the new protected cruiser *Medea*, built at Chatham and engined by Messrs. Humphrys and Tennant, completed her contractors' machinery trials at Portsmouth. As she is the first ship of her type as yet tried under steam, it was deemed necessary that the performances under the different conditions of trial should be carefully noted, not only for the purpose of determining whether modifications were called for in the class to which she belongs, in order that the engines might utilise their full capacity for work upon the ship, but for the information of the constructive department at the Admiralty in designing other similar vessels, of which Lord Charles Beresford lately demanded that 20 should be provided for in the forthcoming Navy Estimates. The trial attracted to Portsmouth a host of experts, among whom may be mentioned, in addition to the local professional officers, Rear-Admiral Hopkins, Controller of the Navy; Mr. W. H. White, Director of Naval Construction; Mr. Richard Sennett, Engineer-in-Chief; Mr. Froude, Superintendent of the Experimental Establishment at Gosport; Mr. Thomas Soper, Admiralty Inspector of Machinery; and Mr. Andrews, from Chatham Yard. The ship was in charge of Commander Hay, and the trials were conducted by Mr. Robert H. Humphrys, belonging to the manufacturers' firm. The other ships of the type are the *Medusa*, like the *Medea*, unsheathed, and the *Melpomene*, *Marathon*, and *Magicienne* (sheathed and coppered). They are 265 ft. long, 42 ft. in beam, with a depth of hold of 23 ft., and are defended against projectiles by a steel turtle-back deck 2 in. thick on the slope, and 1 in. in the horizontal parts

besides being protected in other respects by a great number of compartments and water-tight spaces. They are designed to realise speeds of 20 and 19¼ knots respectively; and, for the purpose of showing at what an enormous expenditure of energy these speeds are attained, it may be mentioned that the *Medea*, with a displacement of 2,800 tons, is fitted with engines of substantially the same I.H.P. as the 16½ knot armour-clad *Collingwood*, with a displacement of 9,500 tons, or between three and four times the weight. The armament of the cruisers consists of six 6 in. 5-ton breechloaders and ten quick-firing guns, in addition to machine guns and torpedoes. They are intended for independent service at sea, and are almost entirely destitute of sails. The engines are of the twin-screw triple-expansion type, with cylinders of 33½ in., 47 in., and 74 in. respectively, and a stroke of 3 ft. 3 in., and are under the protection of the sloping armour deck. The engines were first tried for endurance under natural draught, the continuous full-power run extending over 12 hours. Under the new regulations whereby the steam trials of a new ship are made to afford a practical test of her performances under actual conditions of service, the *Medea* was brought down by ballast to her designed load-line, the draught forward being 15 ft. 3 in., and that aft 17 ft. 9 in., giving a mean immersion of 16 ft. 6 in. The result of the long steaming gave a mean collective I.H.P. of 6,099, and a speed, as measured by log, of from 17 to 18 knots. The crucial run of four hours under forced draught was made on Thursday under favourable conditions of weather. This might also be regarded as a test of endurance, for, besides determining the *maximum* resources of the engines, it may be fairly assumed that, except in action or under circumstances of emergency, they are not likely to be pressed for so long a period at their full power. The mean results of the trial were:—Steam in boilers, 149 lb.; vacuum, 26 in.; revolutions, 140; and collective indicated power, 9,183 horses. Though the power developed was in excess of the contract, and the trial was thus satisfactory from the point of view of the engineers, the speed obtained on the occasion was less than what the ship may be expected to realise when she is finally completed for commission. The trials were in a large measure experimental, and from the few intermediate runs that were made on the measured mile under different rates of speed, it was abundantly obvious that the present form of propeller, in consequence of the great amount of slip noticed, was not exactly suited to the ship. The result was that much of the power developed by the engines was wasted in churning the water. It has been decided to fit the *Medea* with new screws, after which she will be subjected to a series of progressive mile trials. At the conclusion of the trial the *Medea* returned to Chatham.

TRIAL TRIP OF THE ELECTRIC LAUNCH "VISCOUNTESS BURY."

THE official trial trip of this novel craft took place on the Thames on Dec. 20th, a large and distinguished company honouring the occasion with their presence.

The vessel, the dimensions of which appeared in our issue for November, presented a very handsome and unique appearance on the water, the total absence of engines, boiler, coals, and funnel, allowing of the best portion of the boat being devoted to a roomy and elegantly designed and furnished saloon, occupying the whole of the midship portion of the vessel.

The steering wheel placed right forward gives the helmsman a completely uninterrupted outlook ahead, and in close proximity to the wheel are the three switches, one for the starboard and one for the port motor, and the third for controlling the storage batteries so as to alter the output of current according to whether it is desired to go full or only half speed.

After the naming of the vessel, which was gracefully performed by Mrs. Immisch in the absence of the Viscountess Bury, the vessel was taken for her trial run, some forty visitors being on board at the time, and certainly, so far as room was concerned, she would comfortably have carried a dozen or twenty more.

When running full speed ahead a rate of progress equal to thirteen knots per hour was attained, with no perceptible noise and scarcely any vibration, while the handiness of the vessel, both when using the rudder and when manœuvring by means of reversing first one screw and then the other, was proved to demonstration; in fact, from first to last, the trial left nothing to be desired, and Messrs. Immisch & Co. were warmly congratulated by all present.

We propose in an early issue fully illustrating the construction of this vessel, and will leave all further details until that occasion.

HOAR & BROWN'S HARDWOOD MARKET REPORT, December 26th, 1888.

TEAK.—This market is still extremely firm, and, with fresh orders being placed every week, we may expect to see much higher prices. We are assured, moreover, that some shipbuilders have been obliged to refuse orders, having, in one case, at all events, sufficient work in hand to keep their yards well employed for many months, and, in the case to which we especially refer, for three years.

Some Bangkok shipments have been arriving lately containing logs of unusually long lengths and cubic contents. These B.C.L. importations are gaining favour rapidly, and business on an extensive scale is expected in this class of timber.

The deliveries for the four weeks ending 15th December have been 1,192 loads; and for the eleven months of 1888, 15,483 loads, as against 10,203 loads in 1887, and 10,325 loads in 1886.

The stock on the 1st December was 6,503 loads, against 12,703 loads in 1887, and 14,570 loads in 1886.

MAHOGANY.—We have no change to mention, but the market is particularly strong, no Honduras wood being available. The stocks are very moderate, importers only holding a portion of a Tobasco cargo, one small Laguna, and one small Minatitlan cargo now landing.

In Cuba there is little business doing, although some fine stocks are being held both by shippers and dealers at low prices.

WALNUT logs have not been in demand, and the market is bare of good stocks; but the imported plank and square trade still remain brisk, so that the market has been kept well stocked with fair average shipments.

WHITEWOOD logs have not been going much into consumption lately, although buyers at the public sales have been eager to secure parcels at low figures. The plank and board trade has been fairly well patronised.

CEDAR has been going well and good prices obtained, leaving small stocks to be dealt with.

ROSEWOOD.—Prices now asked by holders are so high that business is practically at a standstill.

SEQUOIA (Californian Redwood) is still going along pretty briskly at the usual prices, and stocks decreasing. There are no fresh arrivals to report.

INDUSTRIAL NOTES.

CLYDE AND EAST OF SCOTLAND.

THE Clyde shipbuilding report for the year 1888, which will be issued in a day or two hence, will form a pleasant contrast to the dreary documents of this kind published during the past few years. The report, amongst other things, will prove that a reaction of a most vital character has at last taken place in this long congested industry. This is clearly manifest when I state that during the eleven months ending 30th November the output exceeded the entire production for 1887 by some 60,000 tons gross. To advance a step further, I find from statistics before me that the vessels built and launched in Clyde yards from the 1st January last till the 18th December measured a little more than 262,000 tons gross, or about 77,000 tons in excess of the work completed during the preceding year. Compared with 1886 the increase of tonnage for 1888 is nearly 90,000 tons. These figures prove what I hinted at at the outset, viz., that a distinct improvement has recently taken place in this trade. Besides, it is gratifying to find that there is ample evidence that this brisk state of matters will continue for some time to come. This statement is mainly based on the fact that a very large number of important contracts were placed with Scotch builders during the latter half of the year just closed. Between the 1st August and the 30th November, a period of four months, orders for new vessels aggregating quite 150,000 tons were booked and the prices obtained, particularly during the latter part of this period, were considerably higher than the rates in vogue a few months previously. As a result of this favourable "turn in the tide," the workmen in every department connected with this branch of labour have had their wages increased; so that all associated therewith, master as well as operative, have now good reason to be thankful: they can, besides, console themselves with the reflection that the year will open under the most favourable auspices, *i.e.*, so far as their particular trade is concerned.

The vessels launched betwixt the 1st and 18th December

(inclusive) only numbered six. They were, with one exception, all steamers and made up a combined tonnage of between 17,000 and 18,000 tons. The "exception," viz., the *Liverpool*, has the distinction of being the "largest sailing ship afloat." She has a registered tonnage of 3,300 and is 333 ft. in length, or 125 ft. longer than the *Palgrave*, which, prior to the launch of the *Liverpool*, was the largest sailing ship known. Another notable vessel launched in December was the *Oriental*, a steamer of 5,500 tons gross, built by Messrs. Caird & Co., Greenock, for the P. & O. Company.

Matters in the marine engineering trade have been fairly active during the past four weeks, though I have not learned of any important fresh orders being secured lately.

A good deal is being done just now in Clyde centres in the way of yacht construction. A large number of craft of this description are either building in that district or being designed. Mr. G. L. Watson, the designer of the famous yacht *Thistle*, has quite a small "pile" of such orders under execution, and I understand that some of the other Scotch designers are fully employed with similar work. Altogether, if one may judge from the preparations now being made, next yachting season is likely to be a busy one with West of Scotland yachtsmen. Some of the new vessels, I may add, will possess novel features, *e.g.*, an electric launch being constructed for Mr. H. G. Gold, of London, which will be the first vessel of this kind built for private use. She is to be built by Mr. James Adam, of Greenock.

Amongst the vessels which have changed hands during the bygone month is the ship *Eriminta* (1213 tons register), purchased by Messrs. T. D. Dixon & Son, Belfast, for £2,000 from Messrs. J. D. Clink & Co., Greenock; and a P. & O. steamer, bought by Messrs. Gray & McBeth, Glasgow, and which I believe was subsequently disposed of by the latter firm to a Belfast company.

The works committee of the Clyde Trust inspected the harbour Trust's work at Dalmien and Bowling, and also the new docks at Cesswell, on December 12th. The last-named works continue to progress satisfactorily.

I observe that Mr. David Kirkaldy (an old Glasgow engineer), has just received the honorary freedom of the Turners' Company of London, in recognition of his invention for the testing of iron, steel, and other metals. This is assuredly a case of "Honour to whom honour is due," as it is almost impossible to over-estimate the value of Mr. Kirkaldy's machine, especially to those engaged in the manufacture of steel and iron.

Keen regret was expressed in Scottish shipbuilding circles at the announcement of the death of Mr. John McMillan, Jnr., which took place at Mentone in the early part of the month. Mr. McMillan, I may state, was for some time managing partner of the well-known firm of Messrs. A. McMillan & Son, shipbuilders, Dumbarton, and it was largely owing to his individual efforts that the firm attained to that position of eminence in the shipbuilding world which it at present enjoys. The deceased gentleman was a comparatively young man (I think about forty), so that a life of much promise has thus been cut short.

The leading shipbuilders on the lower end of the Clyde have just presented a memorial to the Greenock Harbour Trust with reference to the dues charged on vessels coming to that port for repairs. The document brought out the interesting fact, viz., that while the due charged in Glasgow is only three halfpence per registered ton, the rate charged at Greenock is one shilling and a penny. The memorialists ask to be relieved of the unfair pressure to which they are thereby subjected, and I believe there is a desire on the part of the Trust to concede the request—meanwhile the matter has been relegated to a committee "for further consideration."

"Two Ocean Monarchs" is the very suggestive title of a booklet just issued at Glasgow, and in which is given a full description of the steamers *City of Paris* and *City of New York*, together with a historical sketch of the firm of J. & G. Thomson, the builders of these notable vessels.

The announcement of the death of Sir William Pearce, the eminent shipbuilder, caused profound regret in the Glasgow district, where the works of the Fairfield Company, of which he was president, are located. The deceased baronet, who was only fifty-three, came to Govan, near Glasgow, in 1863, and, during the quarter of a century which has elapsed since then, he succeeded in winning for himself a reputation such as few in the profession are likely to aspire to. Sir William (who, by the way, was elected first M.P. for the Govan division of Lanarkshire), was, in the best sense of the word, a self-made man, and showed by his wondrous skill, indomitable determination and enterprise, what it is possible for a single individual to accomplish during a comparatively brief lifetime. In private life the deceased gentleman was distinguished for his generosity, and gave freely to the poor of the district in which his reputation was won.

The little harbour of Troon, situated about 30 miles below Glasgow, has of late being doing a good thing in the way of shipping. During the first half of the month, for example, as many as five steamers—all pretty large—arrived at that port, bringing over 46,000 sleeper-blocks and 5,400 sleepers.

Mr. C. Purcell Taylor, C.E., evidently contemplates publishing a history of the marine engine. He stated in a letter to a Glasgow newspaper a few days since, that the marine engine had been his chief study for over twelve years, and asks to be supplied with prospectuses, letters, or other information bearing on that subject. In the same epistle Mr. Taylor alludes in jubilant terms to the movement just set on foot by Mr. Salvesen of Grangemouth, the object of which is to obtain subscriptions for a memorial to Symington, one of the pioneers of the steamboat.

The Rosebery branch of the Boilermakers and Iron Shipbuilders Society—located at Queensferry—appears to be in a thriving condition, since the total income of the branch during its four years' existence amounts to the respectable sum of £1,354 17s. 1d.

When an old boiler is sold should the valves attached always go along with it? I am prompted to ask the question after reading the report of a case which lately came before the Linlithgow Small Debt Court. Messrs. R. Kirk & Co., boilermakers, Paucefield Street, Glasgow, sued Mr. William Blackadder, engineer, Falkirk, for £3 3s. "as being the value of two valves alleged to have been taken by defender from Cathcart Dye Works, belonging to two boilers purchased by pursuer at a sale there." Defender asserted that the valves were connected to some piping purchased by him. The Sheriff came half way, viz., he gave decree for thirty shillings—with expenses.

New pumping machinery, constructed on the most modern principles, has just been erected at the Glasgow Caradon Company's copper mines. The machinery will, I understand, be set in operation on the first day of 1889.

Two machines of a somewhat novel kind are presently on exhibition at the printing works of Messrs. R. & R. Clark, Brandon Street, Edinburgh. These are the "Typotheter" and the "Justifier," and are intended, as the titles suggest, for the setting and justifying of type. The machines are the invention of a Swiss engineer named Lagerman, and it is believed that the apparatus, when fully perfected, will work a sort of revolution in the printing and compositing trade.

In the public works of Glasgow an admirable system prevails by which the workmen are required to contribute so much each per annum to the charitable institutions of the district. In this way the employés of one firm alone (Messrs. John & James Thomson, Finnieston Engine Works) contributed during the past twelve months the sum of £57 17s. to the local infirmaries and kindred institutions.

North of Scotland. — The annual shipbuilding statistics for Dundee district have just been compiled. From these I find that only eight vessels with an aggregate tonnage of 11,197 tons have been built and launched in this quarter during the year 1888. Fifteen vessels of over 14,000 tons were completed during the preceding year, so that there is thus a considerable decrease in the amount of work put out during the twelve months just ended. While, however, this is so, it is satisfactory to note that the prospects for the year on which we are just entering are much brighter than was the case at this time last year. For example, there are just now under construction eleven vessels of fully 16,000 tons, while there were only two ships of 5,126 tons (aggregate) on the stocks at the close of 1887.

The trade in marine engine construction has been fairly busy. Twelve sets of engines of 1,770 N.H.P. were finished since 1st January last, while two of the principal firms have at present under construction thirteen sets of 2,395 H.P.

LEITH NOTES.

THE condition of trade in Leith during the past month has been exceptionally brisk, and orders continue to be received, rendering the prospects for the ensuing year very hopeful. Amongst recent orders placed, Messrs. S. & H. Morton & Co. have received an order for a steamer of 385 tons gross register to be supplied by them with triple-expansion engines of the latest type and all the latest appliances for quick despatch in port. The dimensions of the engines will be 14 in., 22 in., 36 in., by 24 in. stroke; steam pressure 160 lb. Messrs. Hawthorns & Co. have received an order for four coal lighters of 150 tons net register, to be built of steel, and have engines of 54 N.H.P., for the

Admiralty. They are also to triple-expand one of Messrs. J. Currie & Co.'s fleet. Messrs. Ramage & Ferguson are looking forward to a busy time, and they have built a large addition to their boiler shed, making it double its original size. Of work on hand Messrs. Morton & Co. have two steamers, respectively 680 and 1,150 tons gross on their slips, both to be fitted with triple-expansion engines, and double bottom to carry water ballast. Messrs. Hawthorns & Co. have a steel launch on hand which will take the water early in January. They are also triple-expanding one of Messrs. J. Currie & Co.'s traders, and are very busy on two sets of triple-expansion engines, to indicate 750 H.P., for steamers building on the Tyne. Messrs. Ramage & Ferguson launched from their yard the steel screw steamer *Maristow*, 1,706 tons gross, with engines of 160 N.H.P., for Messrs. Bellamy & Co., of Plymouth. They have a large steel sailing ship rapidly approaching completion, and are also laying down a steamer on the slip vacated by the *Maristow*.

TRADE NOTES FROM THE TYNE, WEAR, HARTLEPOOLS, &c.

The Tyne.—As the year draws to a close, inquiries for new steamers are becoming less numerous, and very little is being done in the way of placing fresh contracts. This was no more than was to have been expected, however, as business usually experiences a temporary check at this season, and there is good reason to expect that the revival in shipbuilding, as in other trades, will resume its full force in the early spring. If no more orders were forthcoming, however, the circumstance would not materially affect the state of business in the shipbuilding establishments for many months to come, as all the important firms are provided with work sufficient to keep their machinery going up to a late period of next year. To supplement this large amount of work, however, there will be put into the market the ordinary orders to fill up gaps in shipping that are continually being made by casualties and the natural process of deterioration; and it is, therefore, a matter which does not admit of doubt, that for shipbuilders, the coming year will be at least as busy as the latter half of the present one has been. One of the most interesting events in connection with shipbuilding that has taken place during the month is the re-opening of the Northumberland Shipbuilding Yard, Howdon, now to be known as Edwards & Co.'s Yard. This newly-formed company have appointed as their general manager Mr. Edmund Sharer, who was formerly connected with a large yard at Sunderland, and whose experience and practical ability will no doubt largely contribute to the success of the new venture. The framing of the first vessel laid down is now well advanced, and as early delivery is in this case expressly stipulated for, the execution of the work will be pushed forward with all possible dispatch. Messrs. Readhead, Tyne Dock, continue to keep five berths regularly occupied, new keels being promptly placed in position as soon as vessels are launched. This enterprising firm have lately assumed the proprietorship of a large graving dock in the vicinity of their yard, and this important acquisition will enable them to go into competition for repair contracts on terms of equality with other firms in the district. The firm this year occupy the third position in the output returns which have just been published, and which include all the yards on the Tyne, excepting Sir W. G. Armstrong, Mitchell & Co.'s. The Tyne Shipbuilding Co., who during the present year have turned out five very superior cargo boats of large tonnage, have now four others in progress, besides several to be put down as berths become vacant. The Howdon yard of Messrs. Palmer & Co. is becoming every day busier, and new plant of an effective kind has been put down to aid in the further quickening of production. At the Jarrow yard of the same firm all berths are occupied. Messrs. C. S. Swan & Hunter are fitting out a very finely-modelled steamer named the *Arbib Brothers* beside their yard, and they have four vessels in active progress on the stocks. At the adjoining yard of Messrs. Schlesinger, Davis & Co., where at the opening of the year business was exceedingly slack, there is now a marked appearance of briskness in all departments, and important changes in the way of extension are contemplated. Messrs. Hawthorn, Leslie & Co. have, during the year, commenced and completed a contract for the building of four large and splendidly-equipped steamers for the Greenock Steam Shipping Company, the last of the four (the *Gulf of Martaban*) having been launched a couple of weeks ago. This contract alone would have constituted a good year's work for many shipbuilding yards, but the resources of this establishment are exceptional, and six other vessels of special construction were put off the stocks during the year, besides those built for the Greenock Company. The firm have now about 20,000 tons of shipping on the stocks, the greater part of which will be completed long before the middle of next year. It may be stated that two of the vessels on the stocks are Admiralty orders, and special care is being taken in their construction, the firm having determined to make good their claim for a fair share of these contracts in the future. Messrs. Wigham Richardson & Co. are busily completing the fittings of an Italian passenger steamer lately launched by them, and they have several other vessels of a high class in earlier stages of progress. Sir W. G. Armstrong, Mitchell & Co. have orders for five fast cruisers to be built at their Elswick yard, and it is expected that they will, for the present at all events, discontinue the building of merchant ships at this establishment, reserving such orders for execution at their Low Walker yard. A rumour has been current for some time that a new company was arranging to take over the yard at Scotswood, which formerly belonged to Messrs. Campbell, McIntosh & Bowstead, but which has stood idle for several years. A number of workmen have been lately engaged making alterations in the yard, and this circumstance gives force to the statements that are being made with regard to the early re-opening of the establishment. In the marine engineering trade the general activity is unabated, and most firms are putting down new plant or adopting other needful measures to help the capacity for production. Messrs. Hawthorn, Leslie & Co. have received a large accession of Government work in their marine department, and Messrs. Palmer and Co. have such a plethora of orders that they are obliged to let out some portions of the work for execution by other firms. Messrs. Black, Hawthorn & Co. have just completed the engining of the *Serica*, a large vessel which was launched last month by the Sunderland Shipbuilding Company, and they have contracts in hand for more than a dozen sets of engines, to be delivered next year. Messrs. John Abbot & Co. are busy with Colonial contracts for hydraulic machinery, and have also in hand some important orders for gas-making plant. The firm are also executing an order from the Wear Commissioners for appliances required in connection with the dock improvements now going forward. In the foundry exceptionally heavy castings are being produced for various engineering firms on the Tyne and Wear. The anchor shops are kept in full swing with the manufacture of Tyzack's patent stockless anchors, new orders for which are daily being received. The different departments of Messrs. Hawks, Crawshay & Co.'s works are not showing such uniform activity as those of the firm last referred to, but it is understood that the company have a good prospect for next year. Messrs. Emerson, Walker & Thompson Brothers, of Dunston, have orders enough on their books to keep their place busily employed up to next October. The principal speciality is steamer's windlasses, in which line the firm have attained a position of deserved pre-eminence. Among the orders now in hand are five windlasses for steamers that are being built in this country for the Hamburg and American Steam Navigation Company. Three of these windlasses are of the largest size yet made, and will weigh, when completed, 18 tons each. They have small engines attached, and are to be fitted with the firm's patent flat reversing gear, which is understood to possess very special advantages. The firm are making a large addition to their fitting shop, in which the work of erection will in future be exclusively carried on. Messrs. Carrick & Wardale have just completed a large contract for pumps and other descriptions of chemical plant for the Newcastle Chemical Company, and have now in hand an almost equally important order for a chemical factory in Cheshire. There is a well sustained demand for the special type of steamship pumps manufactured by the firm, and in all departments work is being carried on both night and day. Messrs. Donkin & Nichol, of the St. Andrew's Engine Works, have been obliged to decline the acceptance of many orders lately for steam steering-gears and other appliances, owing to their inability to guarantee delivery by specified dates. The firm are, however, putting down a large quantity of new plant, and will, no doubt, be enabled to largely extend their operations in the course of the coming year. The Patent Metallic Packing Company, whose works are situated in contiguity to Messrs. Abbot's factory, Gateshead, are extremely busy, and have been so for many months past. The orders in hand are mostly from engineering firms engaged in the execution of Admiralty contracts, a circumstance which speaks volumes for the effectiveness of the Company's speciality. The last vessel whose engines were fitted with this packing was the fast cruiser *Magician*, launched some months ago at Govan, and engined by Messrs. Hawthorn, Leslie & Co. It appears that in this case, as

well as in all other instances in which the patent metallic packing has been used, exceptionally good results have been experienced. The state of business at the Elswick Ordnance Works has greatly improved during the past few months, and further important extensions are now being made. In the steel works a new forging press of enormous power has been put down, and will shortly be ready for use. Two additional furnaces are being erected, and it is expected that, with these aids to production, the weekly output of forgings will be largely increased. A new establishment for the manufacture of steel and iron rivets has just been started by Messrs. T. C. McFarlane & Co., at Blaydon. The premises are most conveniently situated, and have been fitted up with the best modern machinery, the greater part of which was supplied through Messrs. E. Beckwith & Co., machinery agents, Newcastle and Sunderland. Mr. Wasteneys Smith, Newcastle, has, during the month, received a number of orders for his patent stockless anchors from Continental shipbuilders, besides a further accession of work from home builders.

The Wear.—During December the weather has been favourable for the progress of shipbuilding operations, and a large amount of tonnage has consequently been removed from the stocks to the water. In all cases keels for other vessels have been placed, and there is now scarcely a vacant berth on the river, excepting in two yards that have been for some time inoperative, and are not likely to be again used for shipbuilding purposes. Messrs. J. L. Thompson & Sons have been the busiest builders in the district throughout the year, and have still the largest amount of tonnage on the stocks. To supplement the new work they have lately secured several important alteration and repair contracts, some of which will be executed in local graving docks, and some at their Manors Quay Repairing Works. Among these is the lengthening of a large vessel to the extent of 36 ft., and the adding of spar decks and doubling strakes to others. This firm, who of all northern shipbuilders have for years past shown the greatest readiness to keep pace with modern requirements, are now adding a new department to their yard, in which gas furnaces of the most improved type will be erected, and where new and most effective facilities will be provided for carrying on the earlier stages of ships' construction. Mr. James Laing has began to utilise a piece of ground which was added to his yard a couple of years ago, and has been cleared of old erections which encumbered it in the interval. The keel for a sailing vessel has been laid in this part of the premises, and it is probable that one or two other new berths will be formed later on. In addition to the powerful hydraulic machine for bending keel plates, referred to in last month's notes, Messrs. R. Thompson & Sons are putting down a large machine by Craig & Donald, of Johnstone, which combines a steam squeezer, horizontal punch, and angle-iron cutter in one. The machine is one of the most powerful of the kind that has yet been made. The firm are also making arrangements for adopting the hydraulic system of riveting for frames and beams, and are in other ways generally perfecting their productive facilities. Most of the vessels at present being built, or to be built, in the yard are of a special class, and will, no doubt, when completed, sustain the reputation the firm have already achieved as producers of first-class work. Messrs. Short Brothers, who have an abundance of orders, mostly from local firms, are just now completing a very large cargo boat for one of their oldest customers (Messrs. Taylor & Sanderson), but it will probably not be put off the stocks till next year. They have three others in progress, and expect to launch the whole of them in the first quarter of 1889. Messrs. Doxford have also some large boats in hand for local owners, besides other contracts, and are now utilising the whole of their building space. They have lately adopted the "Lucigen" light, and it is found to be an exceedingly effective illuminator. At many other establishments the "Wells" light has been introduced, and it also appears to give the greatest satisfaction to its users. The Sunderland Shipbuilding Company's yard, which must be looked upon as one of the leading establishments of the Wear, is busier than at any former period, and there being plenty of orders in reserve it must necessarily continue so for some months to come. An ingenious arrangement for punching out manholes (which now occur more frequently than formerly owing to the general adoption of the cellular system of construction), has been in use for some time at this establishment. It can be easily adapted to any ordinary punching machine, and saves two-thirds of the time usually occupied in cutting out such large circular or oblong apertures as those indicated, besides rendering subsequent chipping unnecessary. It is the invention of a foreman in one of the departments, and is protected by full patent rights. Messrs. S. P. Austin & Sons are building a large sailing ship, and are getting a fair amount of repair work for their graving dock. Marine engineering works continue as busy as ever, and, wherever practicable, night shifts are maintained. Most of the firms have repair contracts to execute as well as orders for new engines. A large locally-owned vessel is shortly expected at the Scotia Engine Works to have her existing compound-engines altered to the new quadruple type which is to form the speciality at this establishment. Since the opening of the works some two or three months ago, a great many repair contracts have been executed by the as yet somewhat limited working staff, but the contract to which special reference is now being made is the most important yet undertaken. The alteration to be carried out may be looked upon in the light of an experiment, as it will afford the first opportunity for fairly testing the utility of an important innovation. At the Bloomfield Engine Works business keeps very active, the orders for piston packing and other specialities being very plentiful. The Pier Engine Works continue to be kept well employed, the exceptional advantages which the situation of the establishment offers in connection with steamship repairs being a principal factor in the business success achieved. Messrs. John Lynn & Co. continue to receive more inquiries in reference to the supply of steering gears, steam winches, &c., than they can very readily entertain, and it is only when a fairly reasonable time is allowed for delivery that they can close with would-be purchasers of their products. Other steam winch manufacturers are almost similarly situated, and the same may be said respecting all classes of manufacturers engaged in supplying accessories for steamships. A very active state of business is still to be noticed in both iron and brass founding establishments, and the pressure of work in the forges remains as great as ever. Rivet making establishments are as busy as possible, the demand from both boiler makers and shipbuilders being exceedingly heavy. Messrs. Irving & Jopling have started this branch of business lately, and are carrying it on conjunctively with the manufacture of boilers and water-tanks. Messrs. Lumsden & Co.'s chain and anchor works continue to show a high state of briskness, and the whole of the productive resources are being fully utilized. At Messrs. F. Tyzack & Co.'s rolling mills full activity is the feature, the demand for Bell & Rockliff's rolled sections being very large, and showing a daily growing expansion. At the Castletown Ironworks, which were lately taken over by a newly constituted company, the arrangements for carrying out such alterations as will render them fit for the manufacture of steel plates and angles have now been commenced in good earnest. A large force of workmen are engaged taking down the existing plant, furnaces, &c., nearly the whole of which will be replaced by new plant specially adapted to the work about to be entered on. The contracts for the supply of the machines and other accessories required have been distributed among leading firms in different parts of the country, by which means it is expected that the whole of the needful articles will be supplied soon enough to admit of the complete equipment of the establishment for steel making purposes by the end of March. Very soon after the first deliveries of plates, &c., may be expected to be made to some of the numerous customers that are certain to be secured by the company among the shipbuilders of the Tyne and Wear.

The Hartlepools.—The output of tonnage from the three Hartlepool shipbuilding establishments this year has reached the large total of 73,909 tons. To this Messrs. W. Gray & Co. contributed over 50,000 tons, a production which has never hitherto been reached at any single shipbuilding yard. The capacity for rapid execution of work exhibited at this establishment is, as the above figures prove, quite exceptional, and is not to be accounted for by the mere fact that all modern accessories for carrying on work in the most effective manner are provided. To intelligent and judicious management a large share of the great success achieved must be attributed, and also perhaps to the existence and close observance of a regulation which will not permit unnecessary abstentions from their duties by the workmen ordinarily engaged. Messrs. Withy have not the amount of building space at their disposal possessed by their enterprising neighbours, but they have neglected no opportunity to improve their working facilities, and their output this year has consequently reached the satisfactory figure of 20,000 and odd tons. This, however, by no means represents the actual work done, as there were several heavy repair contracts executed by the firm during the year, among which may be particularised the lengthening of Messrs. Donald Currie and Co.'s liner, *Roslin Castle*, a contract which is said to have involved the employment of as much labour as the construction of a new vessel of average size. Messrs. Irvine & Co. only launched two vessels, representing a total tonnage of less than 4,000 tons,

but this firm also has during the greater part of the year been largely engaged in repair work. There is an abundance of new work at this centre to commence the year with, but an important section of the operatives have given notice for an advance of 12½ per cent. on the wages rate, to take effect on January 16th, and it is thought possible that the putting forward of this claim may result in a temporary stoppage of work. At the Central Marine Engineering Works, and also at Messrs. Richardson's, the activity noted on former occasions is maintained. As an instance of the capacity for rapid execution of certain descriptions of work possessed by the latter firm, it may be mentioned that a large steel crank shaft manufactured from ingot steel was recently turned out completed in four days from the receipt of the order.

The Tees.—Shipbuilding at Stockton and Middlesbrough continues active, and the orders in hand are amply sufficient to ensure a continuance of briskness during the whole of next year. Messrs. Raylton, Dixon & Co. have just launched a splendid steamer, ordered by Messrs. Wilson & Sons, Hull, and they have other vessels of a superior class in progress. Marine engineers continue to have as much work as they can effectively deal with, Messrs. Blair & Co. taking special prominence in this line. In bridge works a fair business is being done, and boiler-making establishments are, as a rule, kept working to their very fullest capacity. The various ironfoundries are well supplied with orders, and steel manufacturers are so full of work that they are in many cases obliged to decline entering into negotiations for new contracts. The improvement in the iron trade is fairly well maintained, although at this moment the temporary lull, which is usually experienced at the close of a year, is being felt. Manufacturers of gas-making plant, and also makers of steam winches, steering gears, and ship and engine forgings, are doing a satisfactory business.

Darlington.—The Darlington Forge Company have recently added to their plant a powerful saw for cutting iron or steel while in a cold state. The machine was supplied by Mr. Isaac Hill, of the George Street Tool Works, Derby, who has also recently supplied similar machines to the Darlington Wagon Works and Messrs. Rogerson's Steelworks, Stanner's Close.

THE MERSEY.

THERE is but little to report from the Mersey, with the exception of the launch of the screw steamer *Imperial*.

This vessel was successfully launched on the 6th ult. from the Birkenhead Iron Works, and has been built by Messrs. Laird Bros. to the order of the Compania Sud Americano de Vapores of Valparaiso, through Mr. Thomas Dewsbury, their representative in this country. She is intended for the Company's service on the West Coast of South America (which service now extends from Valparaiso right up to Panama), and will form an important addition to their fine fleet. Although very similar, she is of larger dimensions and power than the *Cachapoal* and *Mapocho*, built by Messrs. Laird for the same owners some years since, and which have made a reputation on the coast.

The *Imperial* is a very handsome vessel with a clipper stem, with figure-head representing a water nymph, and an elliptic stern, and will be rigged with three pole masts. She is fitted for water ballast, and will be provided with steam windlass, steam steering gear, and six steam winches. She will also have a complete electric installation, and all the latest and most approved appliances, as a first-class passenger steamer.

One of the boats carried will be a steam launch. Her dimensions are:—Length, 333 ft.; beam, 41 ft.; depth of hold, 23 ft.; tonnage, 2,758 tons O.M.; and she will be propelled by a set of triple-expansion engines, having cylinders 31, 49 and 75 in. in diameter, by 54 in. stroke; supplied with steam at 150 lb. pressure, by two double-ended steel boilers, with six of Fox's corrugated furnaces in each, calculated to develop about 3,000 I.H.P., and to drive the vessel at a very high speed.

To meet the special requirements of the trade, and to secure perfect ventilation, the sides between main and spar decks have been left open, the spar deck being supported on stanchions, and the whole of the accommodation for first-class passengers and officers provided in spacious deck-houses on that deck, under cover of the shade deck, which will afford a magnificent promenade the whole length and width of the ship, and be protected by canvas awning.

There will be accommodation of the most sumptuous character for about 160 first-class passengers in a saloon the full width of the deck-house, above which is the social hall, arranged for music room, card room, smoking room, &c., lighted by a large and beautifully designed cupola skylight, and like the saloons panelled in hard woods, and artistically decorated with painting, and other ornamental work, thorough ventilation and light being secured to the saloon by a central aperture in the floor of the social hall.

A number of third-class passengers will be comfortably provided for on the main deck, and there will be space for a large number of cattle.

The *Imperial* was christened by Miss Florence Dewsbury, and there were present a number of gentlemen interested in the West Coast trade, among whom may be mentioned Mr. Dewsbury, representing the owners; Captain Stewart, the commander of the vessel; Mr. Thackerah, inspecting engineer; Mr. Geo. Brownell; Mr. G. Lewis, of Valparaiso; Mr. Curry, of London; Mr. D. W. Allardice and Mrs. Allardice, Lady Cust, Mr. Maudling, R.N., Mr. Sharpe, R.N., Mr. Coleman, R.N., Mr. A. Winnell, of Hamburg; also Mr. Walter Crane, Mr. Champney, Mr. McMurdo, and several other gentlemen connected with the Art Congress.

The steamer *Nicaragua*, lately bought by Messrs. Furniss, of West Hartlepool, has just been purchased by Messrs. Gondrand Frères, of Genoa. She is now undergoing extensive alterations in Liverpool. The purchasers are putting steam-steering gear into the vessel, and are erecting a new topgallant forecastle.

Freights have, during the past month, been very disappointing; both outward and homeward freights to all parts of the world have continued to decline. There is no absolute occasion for the fall that has occurred, but a multiplicity of small things coming together has been made the most of by bear operators. The early winter in the Baltic and the Black Sea has driven tonnage away from those directions at a date for which no one was prepared, and as there has been no provision made for this contingency, the glut of tonnage has been felt all round. From Odessa rates are quite nominal—nothing but prompt tonnage will be looked at; but as the rates now being accepted are anything but tempting, there is no doubt the recovery will be quite as rapid as the fall. The encouraging feature in this direction is that whilst the present rates are quite nominal at 15s., the March rate is quite 10s. better, thus clearly demonstrating the fact that the present dulness is only of a temporary nature, and that the future contains important elements of improvement.

Indian rates are the turn lower outwards, but the home freights are fairly steady, and practically no change has occurred. From Bombay—the most important market—23s. is still obtainable, and the impression is, that with the Black Sea difficulty passed, more money will be paid.

American freights are quite at a standstill, both for grain and cotton; merchants are not disposed to pay the money that shipowners demand, and as the latter maintain a firm front, and keep their tonnage in other trades, a sort of deadlock has occurred. Cotton is not moving freely, so that merchants are also in a position to wait; but with the turn of the year produce will be more plentiful, and it is quite expected an upward movement will be established.

The Board of Trade returns still indicate an improvement in the volume of business, both in imports and exports, but the very improvement itself, in some direction, is affecting the freight market injuriously. Coal freights, perhaps the most important item of export, has been for December almost at a standstill from the difficulty that the collieries have experienced in fulfilling their engagements, more especially for Eastern markets. This has not occurred through any recent limit in the output of the coal, but through the demand and consequent engagements, far exceeding what had been anticipated. No doubt the colliery strikes that have occurred have materially reduced the stocks, so that there is no possible assistance for the colliery proprietors beyond the present output.

WELSH NOTES.

THE union of the various Welsh railway systems to which we referred in our last issue is not being received with general enthusiasm. It is very properly pointed out that whilst South Wales possesses the most profitable railways in the principality, or even in the country altogether, there are in the same district, and in Mid-Wales, a collection of the most generally wretched lines it is possible to imagine. Not the smallest drawback attached to these lines is the comparatively poor districts some of them serve. Take the Neath and Brecon, part of which is worked by the Mid-

land Company. For a considerable distance from Swansea, and in the part where there are the most works, there is the competition of the Great Western. So far as passenger traffic is concerned, the trains are too slow and run at too great intervals to attract any passengers except such as are going up the Swansea Valley. You can go by it to the North, if you wish, and you would reach your destination truly enough, but by another route you would complete your journey in much less time. Now, why could not this be changed? If one or two fast trains per day were arranged, it appears to us that there would be a very distinct change, for the route is decidedly a pretty one, and might be made to possess advantages over other routes to the North. Then, another Welsh line is the Manchester and Milford. It runs from Pencader to Aberystwith, and in the intervals of business the stationmasters' cows are allowed to graze on the line. Evidently the local cowkeepers have very much less fear of either engine or cow than had the worthy chairman of committee, who asked George Stephenson with such solicitude after an imaginary stray cow on the Stockton and Darlington. The lines to which we refer are not exceptions, merely specimens of some Welsh lines. Does it not appear ridiculous, then, to coolly seek parliamentary sanction to the Welsh Union Railways Bill as at present framed?

An amalgamation, which may, however, take place before many years are over, is a joining of forces by the Rhymney, the Taff Vale, the Barry Dock and Railways, and the Bute Docks. This scheme is in the far future, perhaps, but it will assuredly come to pass one day.

The Newport people have every reason to be proud of their town, but they sometimes let their desires run away with their discretion. For example, at the last monthly meeting of the local Chamber of Commerce, it was resolved to ask Sir George Elliott, the local member, to put Newport forward as a desirable place for a Government coaling station. We should much like to know where the necessary accommodation for ironclads could be found. The only place suitable for a Government coaling station in the Bristol Channel, in addition to Milford, is Swansea Bay, and even there it would be necessary to construct a pier or breakwater. By the way, this reminds us of the action of the Swansea people in connection with a Bristol Channel Harbour of Refuge. They wish the harbour to be constructed at the Mumbles. The other towns, Cardiff, Newport and Bristol, maintain that Lundy Island is the better site. Now, instead of gracefully falling in with the majority, Swansea sulks, and has point blank refused to have any more to do with the scheme. Apart altogether from the childishness of this sulking, it is decidedly bad policy. No one can deny that a Refuge Harbour is very necessary in the Bristol Channel, but when Government finds local quarrelling, it will very naturally conclude that it is self-aggrandisement which is being sought for, not the better protection of life and property at sea.

The scheme for constructing a pier at the Mumbles remains at the time of this writing somewhat in abeyance. The Bill will, however, be deposited on the 21st inst., and in our next issue we shall have more to say about it. Meanwhile, the solicitor to the scheme, Mr. Nicol Morgan, says it is not proposed to have the pier utilised for coaling purposes, and he occupies his spare moments in telling a local landowner, Mr. Graham Vivian, that he lies. Mr. Vivian returns the compliment, and the local people are amused generally. The Vivian family possess some influence in the district, and it is confidently supposed that they will do all in their power to damn the scheme. If they make any such attempt we shall have more to say about the matter, and so, we should imagine, will many more journalists who really have the interest of South Wales trade at heart.

It is satisfactory to find Cardiff at length paying attention to the merits of that place and Swansea for a transatlantic mail trade, and it is more satisfactory still to find in the leading Cardiff daily paper a frank and graceful admission that Swansea would be a more suitable place than Cardiff, were the Harbour Trustees at the former place to continue their attempts to secure a deep water entrance. There can be no doubt that this is the proper view to take, and we find it extremely difficult to understand the lassitude of Swansea port authorities. The Docks Committee of the Bristol Corporation have put the advantages possessed by their port as a point of departure for the West Indian Mail steamers fully before the leading shipowners, but Swansea, which possesses greatly superior advantages, has made never a move. A year or two ago one was always hearing of Swansea, but now, under the reign of a new harbour master, no attempt whatever is made to push the port as it should be pushed. The port possesses wonderful advantages, and in allowing these advantages to be kept from the public, the new harbour master, it appears to us, is not fulfilling his duty.

It is satisfactory to learn that the Swansea Harbour Trustees have decided to extend the siding accommodation at their East Dock. In view of the approaching opening of the Rhondda and Swansea Bay Railway, this is very necessary. The next thing to be taken in hand is the construction of increased tipping accommodation at the East Dock. It is no use having the coals to ship if proper arrangements are not made to tip them.

Considerable attention was recently paid, not only in South Wales, but in London also, to the action of the National Provincial Bank against one of their Cardiff officials named Marshall. Mr. Marshall had entered into an arrangement with the National Provincial Bank not to take service in any other bank within a certain radius of Cardiff, under a penalty of £1,000. He was offered and accepted the post of branch manager with the South Wales Union Bank, whose headquarters are in Swansea, and was under the impression that by paying the £1,000 penalty he could do this. An action was, however, commenced against him, with the result that an injunction was granted restraining him from engaging himself with any other bank in Cardiff. The National Provincial Bank are, however, acting very handsomely now that they have secured the injunction, for they have not only paid their own costs, but offered to take Mr. Marshall back again into their employment should he wish it.

Considerable friction is being caused in connection with the pilotage arrangements of the new Barry Dock. When the new Dock was commenced it was understood that it would be within the limits of the Cardiff port. In consequence of this three Barry Dock representatives were given seats on the Cardiff Pilotage Board. They have recently demanded that less pilotage should be charged to Barry than to Cardiff, seeing that the first-named place is nearer the Wash Point than is Cardiff. The pilots, however, pointed out that this would make no difference to them as they could only take in one ship per tide. In consequence of this the Barry Company are applying to Parliament for the necessary powers to make this place a port of itself with its own staff of pilots. Considerable opposition is threatened, but it appears to us that the Barry authorities are pursuing a very proper course under the circumstances.

If one thing is more needed in Swansea, as the metallurgical capital of the world, more than another, it is a Technical or Science College. A number of scientists engaged in the district are Germans, and those who are not have obtained their education either in Germany or at the School of Mines in London. It appears that an attempt may be shortly made to secure the necessary educational facilities in Swansea, for the Mayor has offered £1000 towards establishing a really good local college. Possibly the new college might not be purely scientific, but there can be no doubt science would receive a more than ordinary share of attention.

Some interesting statistics relating to the Welsh coal and iron trades for the eleven months of 1888 have been issued. Taking the coal trade as a whole we find that 9,736,714 tons have been shipped, and of this Cardiff contributes 7,799,051, Newport 2,004,336, Swansea 820,107, and Llanelly 113,220. It will thus be seen that Cardiff and Newport are far ahead of the other ports. In iron shipments, however, Newport heads the list with 137,935, Cardiff coming second with 54,800. In coke, Cardiff ships ten times as much as any other Welsh port, but in patent fuel is second to Swansea, the respective figures being Swansea 236,118, Cardiff 175,473. Newport makes a poor third with 52,293 tons, but then she possesses only one works. At the same time it is necessary to bear in mind that Swansea's shipments are the product of two works only whilst Cardiff has at least four. The comparatively small quantity of coke shipped in Wales is worthy of note. There is a good demand for it, and it appears strange that more coke ovens are not erected.

Welsh coal prices continue to harden, and the ultimate result will be a falling off to some extent in shipments. Welsh coal is worth only a certain price to many consumers, and when the limit is reached north country coal will be taken instead. In November the export of Cardiff coal was 708,510 tons as compared with 754,066 shipped in October. This decrease is accounted for by a dearth of tonnage, but at the same time there is no reason to suppose that the rise in prices had anything to do with it. The result of the high prices will, however, be more marked later on in 1889, when the shipments of coals on contracts taken from Cardiff to the North are being made. The latest news as to contracts thus removed is that two for the supplies to Indian and Egyptian stations for 240,000 tons have been placed on Tyneside instead of in Wales.

BELFAST TRADE NOTES.

TRADE continues in the same state as reported last month. The s.s. *Lord Londonderry*, recently launched by Messrs. Harland & Wolff, has been towed to Glasgow to receive her engines and boilers. The s.s. *Cufic*, new steamer for the White Star Line, left here for Liverpool on 1st December.

As to the "racers," if we may call them so, for the White Star Line, we understand that the twin-screw engines are of the following dimensions: High pressure cylinder, 45 in. diameter, intermediate 68 in. diameter, low pressure 110 in. diameter, and stroke 60 in., working pressure of steam 180 lb. In order that the propellers may be brought nearer the centre of the ship, the stern post opening is very much longer fore and aft than usual, and one propeller will project farther from the sternpost than the other.

There will be some important launches to chronicle within the ensuing two months.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—ENGLISH.

Monaco.—On November 24th a steamer for pleasure purposes, embodying several novel constructive features, was launched from the works of Messrs. T. G. Tagg & Son, of East Molesey. The vessel has been designed by Mr. T. Tagg with a view to her utilization either for canal, river, or sea purposes, as well as for transport overland for inland lake navigation. The *Monaco* is 55 ft. 6 in. long over all, with a beam of 8 ft. 6 in., and a midship depth of 4 ft., and is teak and mahogany built, all her joints being made on a new principle with Tagg's caulking felt. She is copper-fastened and has very fine lines, a special feature being her cut-away stern, the counter commencing from about the centre of the vessel. She is provided with good cabin accommodation, and has three sleeping berths, her main cabin being fitted with a sliding roof for ventilation and coolness in hot climates. The *Monaco* is fitted with compound-condensing engines of 5 N.H.P., and her boiler is of the marine return-tube type. Her propeller is a three-blade delta metal screw, 3 ft. in diameter, and she is fitted with a balanced rudder. She will carry three tons of coal, and is so constructed that she can be lifted and taken on board a ship or loaded out of railway trucks for overland transport without fear of injury from straining.

Sharpshooter.—On November 30th the *Sharpshooter*, one of the new class of gunboats, was successfully launched at Devonport dockyard. The *Sharpshooter* has been designed by Mr. W. H. White, Assistant-Controller and Director of Naval Construction. She is an improvement on the *Sandfly* and the *Spider*; her length is 330 ft., and beam 27 ft., her displacement being 740 tons. She is constructed of steel throughout, and has a topgallant forecastle and a conning-tower, highly elevated forward, upon which will be placed the electric light. These features give the vessel an unusual appearance. She is built on the transverse principle, and has watertight compartments, provided with doors at short intervals to confine any leakages. A bulkhead partition fore-and-aft, dividing the engine-rooms, further protects the vessel from casualty. The engines and boilers are protected by having coal bunks over them, and a steel deck shields the vessel from the effects of shot and shell in action. The armament is two 36-pounder and four three-pounder quick-firing guns, one bow torpedo-tube and two torpedo tubes on each broadside. The machinery has been constructed by Messrs. Bellis & Co., Ledsam Works, Birmingham. The vessel will be propelled by twin screws, driven by a pair of triple-exhaustion engines of the vertical type. She is expected to develop a speed of 21 knots with forced draught.

Sir Albert Rollitt.—On November 30th a steam trawler, built at Hull, for the Fleet of the Humber Steam Trawling Company (Limited), by Messrs. Cook, Welton & Gemmell, was launched into the Humber. The vessel was named the *Sir Albert Rollitt*. Her dimensions are—95 ft. in length, 20 ft. 9 in. beam, and 11 ft. depth. She is sister ship to the trawlers *Prime Minister* and *Lord Chancellor*, supplied by the same builders, and is fitted with the latest improvements. Engines of 45 H.P., with large boilers, are to be supplied by Messrs. Bailey & Leetham. The ceremony was performed by Mrs. Richard Simpson.

Elfrida.—On December 1st Messrs. Osbourne, Graham & Co. launched at Hylton a steel screw steamer of about 3,500 tons capacity, which they have built to the order of Messrs. Pyman, Bell & Co., of Newcastle-on-Tyne. The dimensions are:—Length, 290 ft.; breadth, 38 ft.; depth, moulded, 22 ft. 6 in. She has a short full poop, raised quarterdeck, and long bridge extending to foremast, with open topgallant forecastle. Ample accommodation for captain, officers, and a few passengers, is provided aft; and for engineers, firemen, and sailors, in the bridge. She will be fitted with tri-compound engines by the North-Eastern Marine Engineering Company, Limited, at Sunderland, of about 200 N.H.P., the cylinders being 22 in., 36½ in., and 60 in. in diameter, with 42 in. stroke, with large boilers working at 160 lb. pressure per square inch. She will also have four powerful steam winches by Messrs. Welford Bros., a "Horace" patent auxiliary boiler, direct-acting steam windlass, by Messrs. Clark, Chapman, Parsons & Co., patent stockless anchors to draw into the hawse pipes, and all the most modern appliances required for a first-class cargo steamer. Captain Danby has superintended the vessel during construction, and the shell is protected from corrosion with his patent cement, instead of the usual "Portland." She was named *Elfrida* by Miss Ida Bell, of Newcastle.

Asagav.—On December 3rd there was launched from Mr. James Laing's Deptford Yard, Sunderland, a steamer, built to the order of Messrs. Holme, Ringer & Co., of Nagasaki, who are represented in this country by R. M. Smith, of Ayr. The *Asagav*, as the vessel was named, is built of steel, her dimensions being:—Length, 308 ft.; breadth, 39 ft.; moulded depth, 26 ft. 9 in. She will be engined by Mr. Geo. Clark, of Southwick. Her deadweight carrying capacity is about 3,600 tons on Lloyd's freeboard. The vessel is intended to run coals from Nagasaki to Hong Kong. The saloon has accommodation for six first-class passengers.

Banan.—On December 4th this vessel was successfully launched from the yard of Messrs. Wm. Doxford & Sons, at Pallion. She has been built to the order of Thorvald Dannevig, Esq., Kristiania, for the general trades, is entirely of steel, and built to Lloyd's 100 A1 class. She has also been built under special survey of the Norwegian Veritas, and has obtained the highest class (1 A1) under the superintendence of Mr. Bodi, and she has been inspected by Mr. Stenerson on behalf of the owner. Length between perpendiculars, 215 ft.; breadth, extreme, 30 ft.; depth, 16 ft. 6 in. The engines are triple-expansion three cranks, with all Messrs. Doxford's latest improvements, the cylinders being 16½ in., 27½ in., and 44 in. diameter respectively, and the stroke 30 in., and they are supplied with high pressure steam from exceptionally large boilers. She is fitted with Messrs. Bow McLachlan's patent steam steering gear and Hastie's screw gear aft, and has three 6 in. by 10 in. and one 7 in. by 12 in. horizontal steam winches by Messrs. Welford Bros., of Pallion, with all the most recent improvements for cargo purposes. The cabins are most tastefully constructed in mahogany amidships, and give comfortable quarters for the captain, the officers and engineers being berthed aft, and crew in forecastle. She is a sister ship to the s.s. *Kong Frode*, recently built by Messrs. Doxford's for the Det Sondenij Norski Dampskibsselskab, of Kristiania.

Missouri.—On December 4th Messrs. W. Gray & Co. launched from their New Central Shipyard a fine steel screw-steamer 330 ft. long, 40 ft. wide, and 29 ft. 6 in. deep, built to the order of Messrs. Williams, Torrey & Field, Limited, London. The vessel takes Lloyd's highest class, will carry 4,100 tons deadweight, and is to run between London, Swansea and Baltimore, being the latest addition to the Atlantic Transport line of steamers, which includes such steamers as the *Surrey*, *Maryland*, *Maine* and *Swansea*, also built by Messrs. Gray & Co. The new vessel has an extra thick iron spar deck sheathed with wood, an extra thick iron main deck, and a tier of beams in the holds suitable for a third deck, and the poop, bridge and forecastle are joined by a shelter deck for cattle. The bottom is constructed on an improved cellular double-bottom principle. Six watertight bulkheads are fitted, and a permanent iron fore-and-aft bulkhead in the holds to prevent shifting of cargo. Three strakes of shell plating are doubled at the bilge and topsides, and extra web-framing fitted inside—above Lloyd's requirements. All the principle plating is in long lengths, and in addition to a deep bar keel, bilge keels are fitted. Three pole masts will be fitted with yards on the foremast, and a smart rig; four hatches, with a powerful steam winch at each and connected to work the bilge pumps; a steam windlass with capstan on the forecastle; steam steering gear in house amidships, and screw steering gear aft; a horizontal multitubular donkey-boiler, a distiller to supply 4,000 gallons of fresh water per day into large deck cattle-tanks

and overflow into fore-peak tank. A handsome saloon, state-rooms for a few passengers, captain's room, ice house, &c., are fitted up in the poop. The officers are berthed at the fore part of the bridge. Arrangements of the most improved kind are made for conveying about 500 cattle, and a large number of ventilators are fitted to ensure a good supply of fresh air to every part. Side coaling and cargo ports are fitted, and everything is provided which can contribute to the safety and efficiency of the vessel. The engines are of the triple-expansion type, working on three cranks. They are supplied by the Central Marine Engineering Company, West Hartlepool, and possess all the latest improvements which the experience of the firm in triple-expansion engines has produced. The cylinders are 25 in., 40 in. and 65 in. in diameter, and the stroke of all the pistons is 42 in. The details of the engines are similar to those of the s.s. *Maryland*, *Maine* and *Montana*, which have been at work for some time on the Atlantic with the most satisfactory results. The boilers are of the double-ended type and designed for a working pressure of 160 lb. per square inch. They are exceptionally large, and are intended to work under natural draught, supplying steam for the development of 1,400 I.H.P. in regular work at sea. The speed will be about 11 knots an hour. The engines and boilers have been built under the superintendence of Mr. A. E. Allen, of Hull, the engineer superintendent for the owners, while the ship and equipments have been under the superintendence of Mr. F. Murrell, of Cardiff, and Captain R. Robinson. The christening ceremony was gracefully performed by Mrs. Torrey, wife of one of the owners, who named the steamer *Missouri*. Captain H. Murrell, late of the s.s. *Maine*, takes command of the *Missouri*, which will be ready for sea in a month. The *Missouri* is No. 346 in the builders' books, but she is the first vessel launched from their New Central yard. In the laying out of the new yard the builders have been guided by their large experience of the requirements of a modern shipbuilding establishment, and have provided the most approved appliances in every department for building the strongest class of vessels. The yard is commodious, and the gas furnaces, hydraulic riveting machines, smithies, machine sheds, with large punching, shearing, drilling, planing, and bending machines, etc., and the railways, travelling cranes and electric lighting are so arranged as to facilitate the progress of work to the utmost. A numerous company of ladies and gentlemen witnessed the launch, and a select party adjourned to the drawing office, where the usual toasts were heartily given and responded to.

Gulf of Martaban.—On December 4th Messrs. Hawthorne, Leslie & Co., Newcastle-on-Tyne, launched a new Gulf liner. Dimensions:—Length, 320 ft.; breadth, 40 ft.; depth, 24 ft.; having long poop, long bridge, and topgallant forecastle, with cellular double bottom for water ballast. It is built of Siemens-Martin's steel to class 100 A1 at Lloyd's, and to pass Board of Trade passenger certificate, and also those of the Admiralty for transport service. The poop will be fitted for first-class passengers. The bridge will contain officers' and second-class passengers' berths, the crew and firemen being berthed in the forecastle. The between decks have been built exceptionally high for carrying emigrants or troops. The vessel is brig-rigged, with steel masts. This is the last of four vessels built by Messrs. Hawthorne, Leslie & Co. for the Greenock Steamship Company for their Gulf Line of steamers, and was built under the immediate inspection of Mr. Headlam, the superintendent of the owners. The vessel was christened the *Gulf of Martaban* by Miss Cockbain, of Liverpool. Her deadweight capacity will be about 4,000 tons. The engines, which will be on the triple-expansion principle, with cylinders of 26 in., 42 in., and 69 in. diameter and 48 in. stroke, are by Messrs. Blair & Co., Limited, of Stockton, and will develop about 1,400 H.P., and are expected to drive the vessel at a speed of over 11 knots when at sea. Messrs. Blair will also fit electric lighting throughout and in the holds for use when working cargo. The *Gulf of Martaban* is a sister ship to the *Gulf of Guinea*, now on her maiden voyage to Australia, and will be despatched from London to the same destination early in January, under the command of Captain David Swan.

Port Caroline.—On December 4th there was launched from the yard of Messrs. Wm. Dobson & Co., Low Walker, a steel steamship, built to the order of Messrs. Wm. Milburn & Co., for their Australian Line. The dimensions of the vessel are as follows:—Length over all, 385 ft.; beam, 44 ft.; depth, 29 ft. 6 in.; the capacity for measurement cargo being 6,000 tons. The vessel has been built to the highest class at Lloyd's, and is in many respects in excess of their requirements, and will be placed on the Admiralty list for transports, having accommodation for a large number of troops or third-class passengers. The saloon accommodation contained in a large and commodious poop. The sleeping berths, which are intended to accommodate about 50 first-class passengers, are unusually spacious. The vessel will be fitted throughout with the electric light, as supplied by Messrs. Clarke, Chapman Parsons & Co. The vessel has clipper stem and will be brig-rigged, her lines being of the requisite fineness for a high rate of speed. The decks are of teak throughout, and the vessel in every respect is most elaborately finished. The seamen are berthed in a spacious top-gallant forecastle. The engines, capable of driving the vessel a speed of 15 knots per hour, are by Messrs. Wigham Richardson & Co. As the vessel left the ways she was named the *Port Caroline* by Mrs. John D. Milburn, of West Jesmond House, Newcastle.

Adelaide Lavarello.—On December 4th Messrs. Wigham Richardson & Co. launched from their Neptune Works at Newcastle-on-Tyne a screw steamer for the South American emigrant trade. The steamer, which is 300 ft. by 35 ft. by 26½ ft., was named the *Adelaide Lavarello* by Miss Jessie Christie, youngest daughter of one of the builders. When completed, the *Adelaide Lavarello* will be added to the Lavarello fleet for service between Genoa and the River Plate, for which her extensive fittings have been specially adapted. Her machinery, which has been constructed by her builders, is of great power, to insure a high speed in regular running.

Research.—On December 4th this vessel was launched at Chatham Dockyard. The *Research* was laid down on September 13th of last year as a surveying vessel, and has been sent off the slip with engines, boilers, and everything complete, except the joiner's work and her copper sheathing. She is a composite paddle wheel steamer, 155 ft. in length between the perpendiculars, 24 ft. in extreme breadth, and 39 ft. from outside to outside of paddle-boxes. Her load draught will be 8 ft. 6 in. on an even keel, but she floated at 6 ft. Her engines are disconnecting, and will be able to work together or in reverse directions for handiness in turning or steering. They will work up to 450 I.H.P. Her displacement is 520 tons. Her first duty will be a new survey of the English Channel and the Scilly Islands—a very important work, considering the multiplicity of the commercial traffic and the necessity for its safety of noting all alterations of soundings, banks, and coastlines. This is the first instance, we believe, of any vessel having been launched with engines aboard, complete, in any of Her Majesty's dockyards.

Imperial.—On December 5th there was launched from the Birkenhead Iron Works a screw steamer built by Messrs. Laird Brothers, to the order of the Compania Sud Americana de Vapores, of Valparaiso. She was named the *Imperial*, and is for service on the West Coast of South America (which service now extends from Valparaiso right up to Panama). She is very similar to, but of larger dimensions and power than the *Cachapool* and *Mapocho*, built by Messrs. Laird for the same owners some years since. The *Imperial* will be rigged with three pole masts. She is fitted for water ballast, and will be provided with steam windlass, steam steering gear, and six steam winches. She will also have a complete electric lighting installation, and all the latest and most approved appliances as a first-class passenger steamer. One of the boats carried will be a steam launch. Dimensions:—Length, 333 ft.; beam, 41 ft.; depth of hold, 23 ft.; tonnage, 2,758 tons, O.M. She will be propelled by a set of triple-expansion engines, having cylinders 31 in., 49 in., and 75 in. in diameter by 54 in. stroke, supplied with steam at 150 lb. pressure by two double-ended steel boilers, with six of Fox's corrugated furnaces in each, calculated to develop about 3,000 I.H.P., and to drive the vessel at a very high speed. To meet the special requirements of the trade, and secure perfect ventilation, the sides between main and spar decks have been left open, the spar deck being supported on stanchions, and the whole of the accommodation for first-class passengers and officers provided in spacious deck-houses on that deck. There will be accommodation for about 160 first-class passengers in a saloon. A number of third-class passengers will be provided for on the main dock, and there will be space for a large number of cattle. The *Imperial* was named by Miss Florence Dewsbury.

Duquesa de Vistahermosa.—On December 5th, at the Howdon yard of Palmer's Company, a steel screw steamer was launched, of the following dimensions:—290 ft. by 40 ft. by 21 ft. 4 in. The vessel is built to class 100 A 1 at Lloyd's, is rigged as a two-masted schooner, and has iron main and quarter bridge and forecastle decks, the bridge and forecastle decks being also sheathed with pine. She has a long raised quarter-deck extending to aft end of bridge. There is a long bridge amidships

extending over the engine and boiler space, containing accommodation for captain, officers, and engineers, and a topgallant forecastle for crew and firemen. Four watertight steel bulkheads; water ballast under engine and boiler space in two deep tanks in main and after holds; direct steam windlass; Harrison's patent steam steering gear amidships, and Hastie's screw gear aft. The vessel is fitted with Price's patent self-trimming hatches and all the latest improvements, and will load about 3,350 tons deadweight. She was named by Mrs. Alcala Galiano, wife of the Spanish Consul at Newcastle, the *Duquesa de Vistahermosa*. The vessel has been built to the order of Murietta and Co., of London.

Paddle-wheel Ferry Boat.—On December 6th the first of the two paddle-wheel ferry boats for North Woolwich was successfully launched from the yard of Messrs. B. & H. Green, Blackwall. The vessel is built for the Metropolitan Board of Works for the new free ferry now in course of construction at Woolwich. The hull is of steel with longitudinal bulkheads, as well as water-tight transverse bulkheads, and is double-ended. Her engines and boiler are by Messrs. J. Penn & Sons, of Greenwich.

Iago.—On December 8th there was launched from the yard of Messrs. Raylton, Dixon & Co., Middlesbro', a steel screw-steamer which has been built to the order of Messrs. Wilsons, Sons & Co., of Hull. Her leading dimensions are as follows:—Length, over all, 304 ft. 3 in.; breadth, 38 ft.; depth, 22 ft. 10 in., with a deadweight capacity of 3,600 tons. She has short hood aft with deck-house for steering gear, water ballast in cellular bottom, and long bridge extending to beyond the foremast, and is fitted as a first class cargo boat. Her bulwarks are carried flush from bridge to forecastle. Her engines will be supplied by George Clark, Esq., of Sunderland, on the triple-expansion principle, of 220 N.H.P., having cylinders 23 in., 37 in., and 61 in., by 42 in. stroke. On leaving the ways she was christened the *Iago*. The vessel has been built under the supervision of Mr. Wilkins, marine superintendent for her owners.

Grimsby.—On December 8th there was launched the paddle steamer *Grimsby*, which the Earle Shipbuilding and Engineering Company, Limited, have built to the order of the Manchester, Sheffield, and Lincolnshire Railway Company, for the ferry service between Hull and New Holland, and has been designed with a view to giving much better accommodation for passengers, and greater speed on smaller draught of water, than the present boats. The dimensions are 180 ft. by 25 ft. by 7 ft. 3 in. depth of hold, and the ship is built of steel with an awning deck extending from the stern to the fore part of the paddle-boxes, a large portion of the space under which deck is occupied with a saloon extending the full width of the boat for first-class passengers, and lighted the whole length by sliding windows as well as by a large skylight above. A ladies' room is provided at the after end of this, and a supplementary saloon under the main deck aft is also fitted with dining accommodation, pantry, and bar, &c., for use during excursions. The whole of this part, including lavatories, &c., will be very completely fitted in a handsome style. The fore cabin is under the main deck, extending nearly the whole length forward of the machinery compartment, and will be fitted in a substantial style with all necessary conveniences, and a small forecastle forward is allotted for the crew. The houses on the sponsons are utilised for captain, steward's office, lavatories, &c., and the space around the machinery and boilers under the awning deck will be available for shelter for passengers and luggage. The top of the saloon and the fore-deck will have large seat accommodation, which, where practicable, will be made to serve as life-rafts. The vessel will be steered by steam power from the top of awning-deck amidships, and will be lighted throughout by electricity. Her machinery will consist of a set of diagonal compound direct-acting engines, constructed on novel design of 1,100 I.H.P., which will be supplied with steam of 80 lb. pressure from three steel boilers of the Navy type, arranged to work with natural or artificial draught.

Byron.—On December 10th Messrs. Joseph L. Thompson and Sons launched from the North Sand Shipyard a steel screw steamer of 3,150 tons deadweight, built to the order of Messrs. Glover Brothers, of London. This vessel is built on the web-frame system, having longitudinal stringers, dispensing with the orlop and 'tween deck beams; six steel watertight bulkheads are fitted, and the water ballast tanks are subdivided, having independent filling and discharging suctions. The engines are of 1,000 I.H.P., of the triple-expansion type, and are being fitted by Mr. John Dickinson, of Palmer's Hill Engine Works. The ship and engines have been under the supervision of Mr. Terrot Glover, of Sunderland. The ceremony of naming the vessel *Byron* was performed by Miss Glover.

Cæsar.—On December 13th a steel screw steamer, named the *Cæsar*, built for Mr. August Bredt, Gotha, was launched from the shipbuilding yard of Messrs. C. S. Swan & Hunter, Wallsend. The vessel is of the following dimensions:—Length, 290 ft.; breadth, 42 ft.; depth, moulded, 20 ft. 3 in.; long raised quarter deck, bridge and forecastle joined by a spar deck over the well. Is capable of carrying 3,200 tons deadweight on 18 ft. 6 in. draught. Is fitted with web frames in lieu of hold beams, water ballast in cellular double bottom, all fore and aft, five bulkheads, four steam winches, patent windlass, steam steering gear, and other appliances of the most modern design. The triple-expansion engines and boilers have been built by the Wallsend Slipway and Engineering Company, Limited, and are capable of indicating 1,150 H.P. The vessel is built to the highest class of the Bureau Veritas, built under special survey and under the personal inspection of Mr. A. G. Schaeffer and Captain Brandenburg. The ceremony of naming the vessel was performed by Mrs. Schaeffer.

Start.—On December 17th Messrs. Richardson, Duck & Co. launched from their yard at South Stockton a steel screw steamer of the following dimensions:—Length over all, 307 ft. 4 in.; breadth extreme, 40 ft.; depth in hold, 20 ft. 2 in. The vessel, which has been built to the order of Messrs. Farrar, Groves & Co., of London, has a raised quarter deck and long bridge, with accommodation for captain and officers in poop, engineers in bridge; the crew being berthed forward in a topgallant forecastle. She is built to the highest class at Lloyd's, has a double bottom all fore and aft on the cellular principle, capable of containing about 560 tons of water ballast. She is fitted with an Emerson Walker's patent steam windlass, has a large "Cestus" donkey boiler, four horizontal steam winches, and every modern improvement for the loading and discharging of cargo. The engines, by Messrs. Blair and Co., Limited, of Stockton, have cylinders 22½ in., 37 in., and 61 in. by 42 in. stroke. The vessel has been built under the superintendence of Mr. Andrew Thomson, of Messrs. Thomson and Port, London. The christening ceremony was gracefully performed by Miss Lilian Spence, of The Mumbles, Swansea, the vessel being named *Start*.

Muriel.—On December 18th Messrs. W. Gray & Co. launched a fine steel screw steamer of the following dimensions:—Length over all, 300 ft.; beam, 38 ft.; depth, moulded, 22 ft. 2 in.; built to the order of Messrs. J. Coverdale & Son, West Hartlepool. The vessel will class 100 A1 at Lloyd's, and have large internal and deadweight capacities. She is of the favourite well-decked type, with poop aft containing saloon and cabins for officers and a few passengers, long raised quarterdeck, long bridge of extra strength right up to fore hatch, and containing comfortable quarters for the crew; the usual topgallant forecastle is fitted forward with Emerson, Walker & Co.'s capstan windlass. The hull is built on the web-frame principle, dispensing with hold beams, and giving a clear hold for stowing cargo of the bulkiest description. Five hatchways are fitted, four steam winches, steam steering gear and donkey boiler; double-bottom under each hold for water ballast. The boats are carried on beams overhead, and the vessel will in every respect be well equipped for general trading. First-class engines on the 3-cylinder triple-expansion principle are being supplied by the Central Marine Engineering Co., West Hartlepool. Working on three cranks, they will develop over 1,000 H.P.; the cylinders are 21½ in., 35 in. and 58 in. diameter, and the piston stroke 39 in.; and a constant supply of steam at a working pressure of 150 lb. per square inch will be maintained by fine large steel boilers. The vessel was gracefully christened *Muriel* by Mrs. Coverdale, wife of the managing owner.

Rocklight.—On December 19th there was launched from the yard of Messrs. Oswald Mordaunt & Co., at Southampton, a petroleum tank steamer of the largest size, and fitted with all the latest improvements, and christened the *Rocklight*. She is 323 ft. long, 40 ft. 3 in. beam, and 30 ft. 3 in. moulded depth to spar-deck, and will carry 3,800 tons of petroleum and 400 tons of bunkers upon a light draught. The main features of the vessel, including a continuous tank in the 'tween-decks to act as an expansion tank, have been designed by the builders, but the details of the pumping arrangement, electric light, of bulkhead structure and equipment, are from the specifications and under the superintendence of Messrs. Flannery, Baggallay, & Johnson, of London and Liverpool, whose resident inspector, Mr. Hare, has been present on the work throughout. The machinery by the same builders consists of triple-expansion engines having three cylinders 22½ in., 37 in., and 61 in. diameter, with 39 in. stroke, supplied by steam from boilers three in number, with 4,600 ft. heating surface and 160 lb. working pressure. The engines have

Jay's valve-gear, and also feed-heating arrangement and evaporizer to make up the waste. The cargo pumping will be carried out by three Worthington pumps, two placed aft and the third forward, at a lower level, so as to reduce the lift in case of dealing with crude petroleum, which vaporizes rapidly and makes pumping difficult. These pumps are all driven by a donkey-boiler of multitubular type, and there are besides shore connections for the conveyance of steam from boilers on land to the pumps and all the other auxiliary engines, in ports where the use of fire is forbidden. The vessel is built to the order of Messrs. George Crosbaw & Co., London, to the highest classification of both Lloyd's and the Bureau Veritas, and was gracefully christened by Mrs. Crosbaw, wife of the owner.

Urpeth.—On December 19th there was launched from the shipbuilding yard of Messrs. S. P. Austin & Son, Sunderland, a steel screw steamer, to be employed in the coal trade, of about 1,100 tons gross register, constructed under special survey, to class 100 A 1 at Lloyd's. The vessel is to be rigged as a schooner, has cellular bottom throughout with large water ballast capacity, and extra large hatchways for self-trimming. Machinery of the triple-expansion type will be supplied by the North-Eastern Marine Engineering Company, Limited, to work at 160 lb. pressure; patent windlass by Emerson, Walker & Co. The vessel was named *Urpeth* by Miss Thompson, daughter of Mr. Joseph Thompson, partner in the firm of Messrs. James Joicey & Co., Limited.

Kennett.—On December 20th Messrs. Edward Withy & Co. launched from their yard at Hartlepool a large steel screw steamer, built to the order of George Steel, Esq., of West Hartlepool, for Messrs. Steel, Young & Co., of London. This is the 162nd vessel on the builders' books and is the 30th built in the Hartlepools for the same owners; 27 of these have been built by Messrs. Edward Withy & Co. She is a fine type of a modern cargo boat, measuring over 270 ft. in length, and built throughout of Siemens-Martin steel, with a large measurement and deadweight capacity, and built to the highest class at Lloyd's. The vessel has a long raised quarterdeck, short poop, long bridge-house, and a topgallant forecastle. The holds are fitted with iron grain divisions and iron cargo battens; all decks, deck erections, skylights, bulwarks, bulkheads, etc., are constructed of steel and iron. In the main and after-holds the vessel is built on the web-frame system, which gives great strength and dispenses with all hold beams, thereby enabling the vessel to carry cargoes of the bulkiest description. The cellular bottom is fitted all fore-and-aft for water-ballast (Withy & Sivewright's patent). The greater portion of the plates are in 24 ft. lengths, making the structure of the ship very strong. Four steam winches, donkey boiler, patent steam steering-gear amidships, screw gear aft, direct steam patent windlass under forecastle, and all other modern appliances are fitted for the handy working of the vessel. The saloon and cabin providing accommodation for the captain, etc., is handsomely finished in polished hardwood, with painted panels executed in a very elegant and effective style by the decorative staff of ladies employed by the firm. The steamer will be rigged as a two-masted fore-and-aft schooner, and has been constructed under the personal superintendence of George Steel, Esq. She will be fitted with triple-expansion engines by Messrs. T. Richardson & Sons, of Hartlepool. On leaving the ways the vessel was gracefully christened *Kennett* by Miss Janet W. Cunningham, of Edinburgh.

LAUNCHES—Scotch.

Zuria.—On November 30th Messrs. Archibald Macmillan and Son launched from their dockyard at Dumbarton a steel screw steamer of 2,200 tons gross register, for Spanish owners. The machinery, which is to be of the triple-expansion type, will be supplied by Messrs. Kincaid & Company (Limited), Greenock. The speed of the vessel will be from 11 to 12 knots. The vessel was named the *Zuria*.

Dresden.—On December 1st the Fairfield Shipbuilding and Engineering Company (Limited) launched from their yard on the Clyde a steel screw steamer of about 5,000 tons, which they have built in the short space of 98 days, to the order of the North German Lloyd. The new vessel—named the *Dresden*—is 405 ft. long over all, 46 ft. 6 in. broad, and 33 ft. deep. She has been constructed in accordance with the newest regulations of the Germanischer Lloyd, under their special survey, and will be classed in the highest grade of that society. She also conforms in every respect to the Board of Trade regulations. She is built throughout of the best tough ductile Martin steel, and has two watertight steel decks, all fore and aft, a poop, bridgehouse and topgallant forecastle. The weather and upper decks are of teak, and the deck-houses are of steel and teak. When complete the vessel will have accommodation for about 40 first class, 16 second class, and about 2,000 third class passengers, besides officers and crew. The whole of the cabins and saloons have the most modern appliances for comfort. The *Dresden* is lighted throughout by electricity, for which purpose she has two distinct engines and duplicate dynamos, each furnishing power for about 300 incandescent lights. Provision has been made to guard against fire by suitable sub-division of the ship, and by steam injectors and independent water service. She has 10 large lifeboats, besides collapsible boats. Her arrangements for loading and discharging cargo are very efficient. The propelling machinery, which has been constructed in a similarly short time, being almost ready for placing on board, consists of surface-condensing engines of the triple-expansion type, having three inverted cylinders. The diameters are: High pressure, 30 in.; medium pressure, 50 in.; and low pressure, 80 in.; each adapted for a piston stroke of 4 ft. 6 in. The high pressure cylinder has a piston valve, and the medium and low pressure cylinders double ported slide valves, each of which will be worked by the ordinary double eccentric link motion. The crank shaft is built and, together with the propeller shaft, is made of Vicker steel. The tunnel shafts are of Siemens-Martin steel, and were supplied by Messrs. John Brown & Co., Sheffield. The steam is supplied by two double-ended boilers and one single-ended auxiliary boiler made of steel. The furnaces are 15 in number, and are corrugated. They work to 150 lb. per square inch. The machinery is fitted with all the latest improvements for economising fuel, including a feed water heater, a fresh water producer for the boilers, &c.

Maristow.—On December 1st there was launched from Messrs. Ramage & Ferguson's shipbuilding yard at Leith a steel screw steamer of about 2,500 tons deadweight capacity, built to the order of Messrs. Bellamy & Co., Plymouth. This steamer, which on leaving the ways was named *Maristow* by Miss Bellamy, is an example of the latest type of cargo steamer, having, besides a quarterdeck and topgallant forecastle, a long bridge-deck, extending forward to the foremast. A cellular double-bottom is constructed fore-and-aft for water ballast, and all the most recent appliances for working both the ship and cargo are introduced. The engines, which are triple-expansion, have also been constructed by Messrs. Ramage & Ferguson, and are of about 900 H.P. effective. The *Maristow* is intended chiefly for the Black Sea and Mediterranean trades.

Naikban.—On December 1st Messrs. Wm. Denny & Bros., Dumbarton, launched from their Leven shipyard the *Naikban*, a twin-screw steamer, and a sister ship to the *Syrian*, intended for the trade of the Irrawaddy Flotilla Company, Limited, of Rangoon. The ceremony of naming the vessel was performed by Miss San Pedro, daughter of Captain San Pedro, inspecting officer of the Compania Transatlantica, of Barcelona.

Plover.—On December 1st Messrs. John Fullerton & Co., Paisley, launched from their shipbuilding yard at Merksworth, Paisley, a handsome iron screw steamer of about 300 tons register, built to the highest class at Lloyd's, and fitted with all the latest improvements, having water ballast and steam steering gear, by Messrs. Alley & M'Lellan, Sentinel Works, Glasgow. The steamer will be supplied with engines by Messrs. Hutson & Corbet, Glasgow, and has been built to the order of Messrs. R. Burton and Son, Newport, Mon., and is intended for their own carrying trade. On the dog shores being cut away she was named the *Plover* by Mrs. James Fullerton, Fernlea, Paisley.

Epidauro.—On December 4th a screw passenger steamer was launched from the shipbuilding yard of Messrs. John Scott & Co., at Kinghorn. The vessel, which is of steel throughout, is 155 ft. in length, 23 ft. in breadth, and 10½ ft. in depth, and is built for the Consorzio Vapore Epidauro, Austria. She is fitted up with triple-expansion engines, the working pressure on the boilers being 150. On leaving the ways she was named the *Epidauro* by Miss Ressich, Leith. She will be taken to Leith, whence she will sail for Trieste.

Ramon de Larrinaga.—On December 4th Messrs. Charles Connell & Co. launched from their shipbuilding yard at Scotstoun a steel screw steamer of about 3,300 tons, for Messrs. Larrinaga & Co., Liverpool, constructed to the highest class in Lloyd's, with water ballast right fore-and-aft. As she left the ways she was christened *Ramon de Larrinaga*. Her engines, which are triple-expansion of the most improved type, to indicate

1,500 H.P., are to be fitted by Messrs. John & James Thomson, Finnieston Engine Works, and have been constructed under the personal supervision of Mr. Gilbert S. Goodwin, Liverpool.

Oriental.—On December 5th Messrs. Caird & Co., shipbuilders, Greenock, launched from their yard, for the P. & O. Company, a steel screw steamer of 5,500 tons gross burthen, and of the following dimensions:—Length, 410 ft.; breadth, 48 ft.; and depth, 37 ft. On leaving the ways the new vessel was named the *Oriental* by Miss Pettigrew, daughter of Mr. John Pettigrew, superintending engineer, P. & O. Company. The *Oriental*, which is a sister ship to the *Peninsular*, recently built by Messrs. Caird & Co. for the P. & O. Company, will be supplied by the builders with engines on the inverted direct-acting compound triple-expansion principle of the most improved type, indicating 5,000 effective H.P. Her displacement on a load draught of 25 ft. will be 9,000 tons, with a deadweight carrying capacity of about 4,200 tons. The *Oriental*, which is built entirely of Siemens' mild steel, in accordance with Lloyd's rules for the 100 A1 spar-deck class, has five decks, namely, hurricane, spar, main, lower, and orlop deck, all of steel, the first two being sheathed with teakwood, and the three last-named with pitch-pine. She has accommodation for 180 first-class and 32 second-class passengers, and is constructed in accordance with the requirements of the Admiralty list so that she could be easily converted into a first-class Government transport. Her cabin accommodation is of a very superior description, and the state and dining saloons will be fitted up in a luxurious manner. Her powerful cargo machinery, all on the hydraulic principle, will be supplied by Lord Armstrong's firm. The *Oriental* will fit out for sea at the Victoria Harbour.

Spider.—On December 6th Messrs. Scott & Co., Bowling, launched a steam screw trawler for the North Sea fishing trade, built to the order of Messrs. Knolles & Robins, of Hull. She is of the following dimensions:—100 ft. by 20 ft. 6 in. by 10 ft. 9 in., built to Lloyd's highest class and under their special survey, and was superintended during construction by Mr. Robins. She was named the *Spider* by Miss Tillie Armour, of Kilmalcolm. The machinery, etc., is being supplied by Messrs. Muir & Houston, Harbour Engine Works, Glasgow. She is to be fitted with compound engines, cylinders 16 in. and 32 in. in diameter, with a stroke of 24 in., and will have all the most modern appliances suitable for the trade, with built crank shaft, back balance weights, and extra large boiler power with 100 lb. pressure.

Liverpool.—On December 7th Messrs. Russell & Co. launched from their Kingston Yard, at Port Glasgow, a full-rigged four-masted iron sailing ship of 3,300 tons nett register. Her dimensions are:—Length, 333 ft.; breadth, 47 ft. 10 in.; depth, 26 ft. 6 in. This vessel will carry 5,000 tons deadweight cargo on Lloyd's freeboard. She has been constructed with two iron decks, and a long bridge amidships, where accommodation for 30 seamen and 10 officers and apprentices has been provided. She is supplied with donkey boiler and steam winch on the deck-house, and has two sets of pumps, besides all the most approved appliances for the working of a large cargo-carrying vessel. During construction she was superintended by Captain Enright, Liverpool, and she is built to Lloyd's highest requirements and Bureau Veritas. This vessel has been built to the order of Messrs. R. W. Leyland & Co., Liverpool, and as she left the ways was named *Liverpool* by Miss Adele Lydia Moerchen, of Wiesbaden. She was afterwards towed to the James Watt Dock, Greenock, to fit out, on the completion of which she will be towed to London to load for Melbourne.

LAUNCH—Foreign.

Augusta Victoria.—On December 1st this vessel, an addition to the steamship line of the Hamburger Packetfahrt, was launched from the yard of the Vulcan Company at Bredow. The dimensions are:—Length, 460 ft.; beam, 56 ft.; depth of hold, 38 ft. The machinery comprises two independent triple expansion engines, of a total indicated power of 13,000 horses, supplied with steam from eight double boilers. The coal capacity of the vessel is 2,200 tons. The expected speed is 19 knots, so that the *Augusta Victoria* will be one of the fastest Transatlantic steamers, and her launch deserves mention also because she is the first vessel of this class ever built in a German yard.

TRIAL TRIPS.

Humber.—On November 22nd this fine screw steamer went on her official trial trip at the measured mile off Hartlepool, having loaded railway iron and other goods at Middlesbro' for Bombay. This vessel was built by Messrs. Wm. Gray & Co. to the order of the Mercantile Steam Ship Co., of London, and is fitted with triple-expansion engines by the Central Marine Engineering Co., of West Hartlepool. Her engines are of the size designated by the builders, 1,000 I.H.P., and are supplied with steam from two extra large single-ended steel boilers working at 150 lb. per square inch, fitted with Brown's patent ribbed furnaces. On the day of the trial she was carrying 3,100 tons deadweight on a draught of 19 ft. 7½ in. forward and 21 ft. 1½ in. aft. She weighed anchor in the Tees at 5 a.m. and proceeded down the river. As soon as daylight appeared, Mr. Ainsley put the ship through the usual series of manœuvres for the adjustment of compasses, and at ten o'clock the ship was brought up to the measured mile to test her speed. The engines being opened out to full speed it was found that the north mile with the tide was run at a speed of 10·714 knots per hour, and the south mile against the tide at a speed of 9·917 knots per hour, showing a mean speed of 10⅓ knots per hour. With the engines linked in to 61 revolutions per minute the north mile with the tide gave a speed of 9·6 knots per hour and the south mile against the tide gave a speed of 8·76 knots per hour, showing a mean speed at these revolutions of 9·18 knots per hour. These speeds were regarded as highly satisfactory by those present at the trial, and the condition of things in the engine room was no less satisfactory, for the engines ran without the application of water and without the slightest sign of heating or trouble of any kind, the boilers also maintained the full head of steam with ease throughout the trials. This vessel, both in ship and engine departments, has been built under the personal superintendence of Mr. Terrot Glover, of Sunderland, and the owners were represented in the trial trip by their superintendent engineer, Mr. Henry George Seal, the engine builders being represented by their manager, Mr. Mudd. After the trial the vessel proceeded on her voyage to Bombay, Mr. Seal taking a trip as far as Dover with her, and it has been ascertained from him that the vessel made an average of 9 knots per hour from Hartlepool to the North Foreland against a strong head-wind and heavy sea, the engines being linked in to 63 revolutions per minute, everything working with perfect smoothness and satisfaction throughout the voyage.

Stanley.—On November 24th the trial took place in the Firth of the steel screw steamer *Stanley*, of 1,000 tons gross, when very satisfactory results were achieved, even in unfavourable circumstances on account of the storm, the speed gained being over that contracted for. She was launched at the end of last month by the Fairfield Shipbuilding and Engineering Company (Limited), for the Canadian Government. Captain M'Elhinney, the Government representative, expressed himself highly satisfied with the steamer's behaviour.

Persian Prince.—On November 24th the new s.s. *Persian Prince*, 273 ft. by 40 ft. by 21 ft., built by Messrs. Craig, Taylor and Co., of Stockton-on-Tees, for Messrs. James Knott & Co., Prince Line, was taken out on trial trip off the Tyne. The engines are 185 N.H.P., by Messrs. Westgarth, English & Co., of Middlesbrough, cylinders 22 in., 35 in., and 57 in. by 39 in. The vessel is fitted with all the latest improvements, and the trial was, we are informed, satisfactory to all on board.

Orestes.—On November 27th the iron screw steamer *Orestes*, built and owned by Messrs. Schlesinger, Davis & Co., Wallsend-on-Tyne, was taken to sea for a light trial. The vessel has been built to the highest class in the Liverpool Registry, and is fitted with all the latest improvements for the rapid loading and discharging of cargo. The principal dimensions are as follow:—Length between perpendiculars, 260 ft.; breadth, moulded, 36 ft.; depth, moulded, 20 ft. 2 in; with a deadweight capacity of about 2,400 tons. The engines have been built by Messrs. Black, Hawthorn & Co., Gateshead-on-Tyne, and are of 160 N.H.P. The weather during the trial was exceedingly stormy, and the vessel having been taken to sea in the early morning to adjust her compasses, it was found impossible for the officials to board her from the tug when they went out later in the day. However, during the trial the machinery, etc., worked in a very satisfactory manner. The *Orestes* has been placed by the owners in the hands of Messrs. Adam Bros., Newcastle, who will manage her for them. After the trial the vessel proceeded to Tyne Dock to take on board a cargo of coke for Bilbao.

Margherita.—On November 28th the new steel screw steamer *Margherita*, built by Messrs. Schlesinger, Davis & Co., to the order of Messrs. Leech, Harrison & Forwood, of Liverpool, was taken to sea on trial. The vessel has been built to the highest

class at Lloyd's, under special survey, and is fitted with all the most modern appliances for the rapid loading and discharging of cargo. The principal dimensions are:—Length between perpendiculars, 170 ft.; breadth, moulded, 26 ft.; depth, moulded, 13 ft. 4 in.; with a deadweight capacity of about 700 tons. The engines have been built by the North-Eastern Marine Engineering Company, Wallsend, and are of the triple-expansion type, of 75 N.H.P., with cylinders 14 in., 23 in., and 39 in. by 27 in. stroke. The engines worked with great smoothness, and gave every satisfaction to those on board, and, in spite of the very heavy weather, a mean speed of 10½ knots per hour was attained. The vessel has been purchased by Messrs. Walker & Co., of Venice. The steamer will be taken out to Venice with an Italian crew, under the command of Captain Alexandro Mancini.

Baltic.—On November 29th the trial trip took place of the steam fishing vessel *Baltic*, which Messrs. Earle's Shipbuilding and Engineering Company, Limited, have constructed for the Grimsby Steam Fishing Company, Limited, to the order of Messrs. Moodys & Kelly, of Grimsby. She is a sister ship to the *Arctic*, recently handed over to the same firm, and is of the following dimensions:—Length, 100 ft.; breadth, 20 ft.; depth, 11 ft. 6 in., with a perforated fish well amidships. Owing to the boisterous state of the weather it was not deemed advisable to test the speed, etc., on the measured mile off Withernsea, and a run was accordingly made from the Upper Burcom buoy to the Middle Light, which, although against wind and tide, only occupied 28 minutes for the distance of four-and-a-half miles, a result that was considered by all on board as highly satisfactory. The ship was afterwards taken back to Grimsby, whence she will shortly sail on her first trip to the fishing grounds.

Lady Martin.—On November 29th the new steamer *Lady Martin*, recently launched from the shipbuilding yard of Messrs. Workman, Clark & Co., of Belfast, and built for the British and Irish Steam Packet Company, Dublin, was tried for speed between the Cloch and Cumbrae Lights, when she attained a speed of 13¼ knots per hour with 1,250 tons deadweight on board and in very unfavourable weather. The *Lady Martin* is a vessel of 1,250 tons, and is of the following dimensions, viz.:—Length between perpendiculars, 270 ft.; breadth, moulded, 34 ft.; depth of hold, 16 ft. 6 in. The machinery, constructed by Messrs. Dunsmuir and Jackson, Govan, is of the triple-expansion type. The cylinders are fitted with internal liners, and are of the following diameters:—High-pressure, 24 in.; intermediate pressure, 39 in.; low pressure, 64 in.; stroke, 45 in. The engines are fitted with Brown's patent hydraulic reversing gear. The boilers are two in number, double-ended, and are fitted with Fox's patent corrugated furnaces. They are entirely constructed of steel, and for a working pressure of 160 lb. per square inch. The vessel is fitted throughout with electric light, and the saloon and state-rooms are fitted up in a sumptuous manner for passengers. On deck there are four steam cranes fitted for the rapid discharge of cargo, and otherwise the vessel is excellently adapted for the channel service for which she has been designed. The hull and machinery have been constructed from the designs and under the superintendence of Mr. A. F. White, the company's superintendent engineer.

Amadeo.—A new screw tug-boat named *Amadeo* left the Clyde last month for Pernambuco. She was built by Messrs. Scott & Co., Bowling, and engined by Messrs. Alley & MacLellan, Glasgow, to the order of Messrs. Knowles & Foster, London. She is 85 ft. long, 16 ft. broad, and 10 ft. deep, with a draught aft of 7½ ft. Her engines are of the triple-expansion type, with cylinders 9¼ in., 16 in., and 25 in. in diameter, with a piston stroke of 18 in. Steam is supplied by a boiler 9 ft. in diameter and 8 ft. long, working to a pressure of 160 lb. to the square inch. The heating surface is 630·5 sq. ft., the grate surface 23·5 sq. ft., and the cooling surface in condenser 350 sq. ft. The propeller, which is 6 ft. 6 in. in diameter, has a pitch of 8 ft., and on trial, with the engines indicating 220 H.P., the speed attained was 10 knots.

La Flandre.—On December 1st the new mail boat *La Flandre*, which has been built for the Belgian Government by the Société Cockerill, ran her official trial. The contract speed was 17·5 knots, but a prize of 10,000 francs was to be given for every 1-10th knot in excess of this up to 18·5 knots, a similar sum being deducted for every 1-10th knot below 17·5, and should the speed fall below 17 knots the authorities were to have the option of rejecting the vessel. On trial a mean speed of 19 knots was obtained, a result which was considered very satisfactory.

Eugenie.—On December 4th the s.s. *Eugenie* made her trial trip from the Tees. This vessel has been built by Messrs. Raylton, Dixon & Co., for Messrs. Mohr & Son, of Bergen. Her dimensions are:—Length, 304 ft. 3 in.; breadth, 38 ft.; depth, moulded, 22 ft. 10 in., and has a deadweight carrying capacity of 3,600 tons. Her engines, which have been fitted by Messrs. T. Richardson & Sons, Hartlepool, are on the triple-expansion system, with cylinders 22 in., 35 in., and 59 in., by 39 in., and worked satisfactorily.

Bishopsgate.—On December 5th the steel screw steamer *Bishopsgate*, built by Messrs. J. L. Thompson & Sons, of Sunderland, was taken to sea for her trial trip. The vessel's dimensions are:—Length, 290 ft.; breadth, 38 ft. 8 in.; depth, 22 ft. 3 in.; and has a total carrying capacity of 3,500 tons. The engines are of the triple-expansion type, built by Mr. John Dickinson, of Sunderland, with cylinders 22 in., 37 in., and 60 in., with 39 in. stroke, fitted with all the latest improvements, including Dickinson's arrangement of Bremmes' dynamic valve-gear and Dickinson's patent built crank shafts. The boilers are of an exceptionally large size, with 160 lb. pressure, fitted with Fox's patent corrugated furnaces, and all the latest improvements for ensuring economy of fuel. Worthington duplex pump for feeding main boilers, with pumping connections to all parts of the ship, donkey boiler of extra size, 90 lb. pressure, also fitted with Worthington duplex feed pumps. The vessel has four large steam winches by Messrs. Clark, Chapman & Co., and also a powerful direct-acting steam windlass and steam capstan by the same makers; hand and steam steering gear by Davis, of London, with patent clutch gear aft. Owing to the foggy state of the weather the ship was not taken on the measured mile as no land marks could be seen, but proceeded direct to London, making the run from Sunderland to the Nore in 25 hours, or an average speed of 10½ knots, with two ebb tides against the vessel. The engines were not forced in any way, and worked most smoothly without a single hitch. On the arrival of the vessel in London she proceeded to the Royal Albert Docks to load for the River Plate, and on the Saturday following her arrival Mr. H. W. Dillon, the managing director of the Bishopsgate Steamship Company, Limited, for whom the vessel has been built, entertained a large number of the shareholders at lunch on board the vessel. The numerous company were much pleased with the ship and engines. The vessel and engines were built under Lloyd's special survey, and under the superintendence of Mr. Samuel Walton, consulting engineer to the company. The vessel sailed on Sunday, the 16th, for Monte Video, Buenos Ayres and Rosario.

North Flint.—On December 6th the new steel screw-steamer *North Flint*, built by Messrs. John Readhead & Sons, West Docks, South Shields, was taken to sea on her trial trip. The steamer has been built to the order of Messrs. Hugh Roberts & Son, Newcastle-on-Tyne, and is of the following dimensions, viz.: 290 ft. by 39 ft. by 20 ft., is of the improved well-decked type, having long raised quarter-deck, long bridge amidships and top-gallant forecastle, is classed 100 A 1 at Lloyd's, under special survey, and has been built under the superintendence of Messrs. Farina & Bushell, of Newcastle, and Captain Owen, on behalf of the owners. The vessel is fitted with triple-expansion engines, also built by Messrs. John Readhead & Sons, having cylinders 22 in., 36 in., 60 in., and 39 in. stroke, supplied with steam at a pressure of 160 lb. per square inch, from two large steel boilers, and is fitted up with direct-acting steam windlass and all other recent improvements for economising labour and securing efficiency. On account of the bad weather prevailing last week the steamer was taken into dock, and received her cargo before going on her trial trip. Having taken on board over 3,400 tons of coal, she was taken to sea, the working of the machinery giving the greatest satisfaction, and, during a lengthened trial, going without the slightest hitch of any kind. The speed attained was a mean of 10½ knots per hour. After the conclusion of the trial the *North Flint* proceeded on her voyage to Savona, under the command of Captain Owen.

The Marchioness.—On Thursday morning, December 6th, the new paddle saloon steamer, *The Marchioness*, built to the order of Sir William Thomas Lewis, of Cardiff, by Messrs. Edward Finch & Co., Limited, of Chepstow, for steam packet service between the ports of Bristol and Cardiff, left the Wye to be run on the measured mile in King Road. Before dealing with the performance of this steamer a description of her may be found interesting. *The Marchioness* is 170 ft. long, 22 ft. moulded breadth, and 40 ft. wide over the paddle boxes. Forward there is a roomy under-deck forecastle for the accommodation of her sailors and firemen; then follows a large saloon, 26 ft. by 21 ft.,

with ladies' retiring and refreshment rooms. Abaft of this comes a cargo hold for receiving some 70 tons of general merchandise. Then follows engine and boiler rooms, 44 ft. long, and the bunkers. Abaft the bunkers there is a spacious dining-room for the accommodation of first-class passengers; then follows pantry, captain's cabin, and the berths of officers and chief engineer. Amidships there is a shelter-house, 33 ft. long by 22 ft. wide, and abaft of this is the deck saloon, 55 ft. long by 11 ft. wide, with most convenient ladies' retiring and refreshment rooms. The deck saloon is most elegantly fitted, the sides having corinthian columns of solid teak, with beautifully-carved capitols supporting a suitable entablature. The ceiling is decorated in white and gold, the entablature and beams in white, gold, and Antwerp blue. The whole of the mouldings and woodwork is of polished teak or Honduras mahogany. The seats are upholstered in Utrecht velvet of a bright claret colour, which, with window blinds to suit, and the mirrors, and the rich Japanese paper, gives this saloon a most unique and comfortable appearance. No expense has been spared to make this saloon and the ladies' drawing-room leading from same all that the most fastidious could desire, and the result is that in this respect no passenger steamer that has yet been on service in the Bristol Channel, whether built on the Clyde or elsewhere, is to be compared with *The Marchioness*. The shelter-house in the bridge amidships, to which reference has already been made, is a special feature on this vessel, and will accommodate some 200 persons: it is provided with a large refreshment bar at its after end, and with an elaborate drinking fountain forward. The vessel is divided, by means of bulkheads, into eight distinct watertight compartments, and has pumps capable of discharging 50,000 gallons per hour, so that she is practically unsinkable. This and her great stability, due to the vessel's beam and model, and to the fact that her boilers and machinery (weighing 130 tons in working order) are all below deck, will enable the vessel to proceed to sea and make her passage in any wind or weather. The promenade deck, above the saloon and over the shelter-house, is 95 ft. long. The machinery consists of a pair of vertical oscillating compound surface-condensing engines of 130 N.H.P., steam being supplied at a pressure of 110 lb. per square inch, of two boilers of navy type, each 8 ft. 9 in. diameter by 17 ft. long, which have a combined grate area of over 80 square ft., the furnaces being fitted with Galley's patent Venetian air valve furnace bars, which gave great satisfaction. The engines are of special design, being fitted with Sisson's patent valve gear for oscillating engines. This gear gives a distribution of steam far superior to that of ordinary valve gears with link motion; it enables an altogether more compact design of engine than ordinarily obtains, it is more accessible, the wear is very slight, and that readily taken up, while there is not one "slider" in the whole motion; there is thus less friction, while both valves on each cylinder have a precisely similar motion. These engines are well worthy a visit from marine engineers, they are handled with the greatest ease and rapidity, and their working was all that could be desired. On the measured mile the steamer gave great satisfaction, four runs with and against the tide showing a true mean speed of 14·24 knots per hour. This result was highly satisfactory to Mr. H. W. Lewis, under whose entire supervision the steamer was built, and also to Captain Pomeroy, under whose directions the speed trials were conducted.

Abydos.—On December 7th the *Abydos* (s), which has been built by Messrs. Wigham, Richardson & Co., for the Kosmos Steamship Company, of Hamburg, had a highly satisfactory trial trip at sea. After adjusting compasses the vessel was taken over the measured mile, when she showed a mean speed of over 14½ knots, the engines working perfectly. The *Abydos* has accommodation for a large number of first, second, and third class passengers. Immediately after the trial trip the *Abydos* left for Hamburg in command of Captain Siegmund.

Drumfell.—On December 10th this fine steel screw steamer, which was built by Messrs. Robert Thompson & Sons, Sunderland, went out for a trial trip. The vessel is 305 ft. long, 39 ft. 8 in. beam, has been built under Lloyd's survey for the highest class, and is capable of carring upwards of 4,000 tons deadweight. Her machinery is by the North Eastern Marine Engineering Company, Limited, of Sunderland, the cylinders being 23½ in., 38 in., and 62 in. by 42 in. stroke, and she is fitted with two exceptionally large double-ended boilers, which steamed very easily with the engines running full open. The weather was not favourable for a run on the mile as a heavy swell was running and it was very foggy. The engines, however, were run some time full open, and worked extremely well at 80 revolutions without sign of heating. This vessel is a sister ship to the *Drumburlie*, recently built by the same builders for Messrs. Gillison & Chadwick, of Liverpool, who also own the *Drumfell*. Both vessels have been built from the plans and specifications of Messrs. Flannery & Blakiston, of Liverpool and London, who superintended the construction. The trial of the machinery was so satisfactory that the vessel proceeded at once to Cardiff to load for Bombay.

Ismailia.—On December 11th the screw steamer *Ismailia*, which was recently built by Messrs. Palmer & Co., of Jarrow, for Messrs. Nelson, Donkin & Co., of North Shields, proceeded on her trial trip. The weather was not what might have been desired for a successful run, the meteorological conditions being rather hazy. Despite those drawbacks, however, a few good runs were made along the coast, between the Tyne and Blyth. After a few hours' run the vessel returned to the Tyne, where she was moored. She will shortly proceed to Cardiff, after which she will steam on a voyage to the Cape of Good Hope.

Sir Albert Rollit.—On December 11th the new Hull steam trawler *Sir Albert Rollit* went on her trial trip. This steamer was only launched on November 30th, on which date she was floated into the water a mere shell, and in eleven days she was completed ready for sea. The *Sir Albert Rollit* is the fifth vessel of the fleet of the Humber Steam Trawling Company, Limited, and has been named after the chairman of the company. The new vessel is not intended for carrying purposes, but is a trawler pure and simple. The dimensions of the *Sir Albert Rollit* are 95 ft. by 20 ft. 9 in. by 11 ft. The hull has been built of iron by Messrs. Cook, Welton & Gemmell, and the engines by Messrs. Bailey & Leetham. The ship is built to class 100 A 1 at Lloyd's, and she has been constructed far in excess of Lloyd's rules. All the latest improvements have been taken advantage of in the construction of the ship and her equipments. Her engines are of the compound inverted direct-acting character of 45 N.H.P., which, however, will work up to 270 indicated. The cylinders are 17 in. and 33 in. in diameter, with 22 in. stroke. The boiler, which is built of steel, is 11 ft. in diameter and 9½ feet long, and has a working pressure of 90 lb. to the square inch. It was originally intended to run the measured mile off Withernsea, but it was found that time would not permit this to be done, and so the log was thrown out at the Middle Lightship, and was taken in on the return voyage, when it was found that an average speed of 12·4 knots had been maintained.

Atrato.—On December 13th the steamship *Atrato*, just completed by Messrs. R. Napier & Sons, Glasgow, for the Royal Mail Steam-packet Company, London, was taken down the Firth for her official trials, when a mean speed of 17·20 knots was attained on four runs at the measured mile. This result was considered highly satisfactory by Captain Bevis and Mr. Bowers, the company's representatives, the ship having proved exceptionally fast, steaming more than a knot per hour in excess of the contract speed, and that against a very strong breeze, which was not favourable to obtaining the best results. The vessel then proceeded down channel for a six hours' run at full speed, which was also entirely satisfactory, and returned to the Tail of the Bank in the evening. The massive engines worked most smoothly, and the splendid results were attained without any trace of heating or appearance of priming, and after the completion of the trials the builders were much complimented upon the success of the Ship. The *Atrato* goes round to Southampton, and starts upon her first voyage on January 17th, under the command of Captain Dickenson.

Purnea.—On December 15th the steamer *Purnea*, built for the British India Steam Navigation Company by Messrs. A. & J. Inglis, Pointhouse, completed her trials with the most satisfactory results. The mean speed was 14·05 knots, and the machinery worked throughout in the most perfect manner. The trials were superintended on behalf of the British India Company by Captain Hodgkinson and Mr. Clark, superintendent of the company. Messrs. D. Mackinnon and J. Mackay, of Calcutta, were also present.

Palatine.—On December 15th the s.s. *Palatine*, built by the Palmer Shipbuilding & Iron Company, Limited, to the order of the Durham Steamship Company, Limited, of Newcastle, had her official trial, loaded, having on board 3,100 tons. The dimensions of the vessel are:—Length, 275 ft.; mean breadth, 37½ ft.; depth, 19 ft. She is built on the cellular principle, with raised quarterdeck and long bridge. The engines, which are also by Messrs. Palmer, are of the triple-expansion type, with cylinders of 22 in., 35 in., and 58 in. diameter, with a 42 in. stroke. There are two large boilers, working with a pressure of 160 lb. During

the trial a mean speed of 10½ knots was maintained, after four runs over the measured mile. The steamer is fitted with all the latest improvements to facilitate the quick loading and discharging of her cargoes.

Oanfa.—On December 15th the new China steamer *Oanfa*, lately launched by Messrs. Aitken & Mansel, had her official trial trip. The *Oanfa* is the property of the China Shippers' Mutual Steam Navigation Company, and is fitted up suitably for large carrying of tea and valuable cargo. Although not necessary for a cargo steamer, the decks are all of teak. The engines, of the triple-expansion type, have been constructed by Messrs. John & James Thomson, and during the trial trip worked to perfect satisfaction, the I.H.P. being about 3,000, and the speed of the vessel 13 knots per hour. The *Oanfa* left in the evening for Liverpool.

Charlois.—On December 15th the s.s. *Charlois* went for her trial trip on the Clyde. Her principal dimensions are: Length, 310 ft.; beam, 39 ft.; and depth, 26 ft. 7 in., and she is fitted with triple-expansion engines by Messrs. Duncan, Stewart & Co., of Glasgow, having cylinders 22 in., 36 in., and 58 in., by 42 in. stroke, the boilers being very large, of the single-ended type, and adapted for a working pressure of 160 lb. The vessel has been built by Messrs. Russell & Co., of Port-Glasgow, to the order of Messrs. R. W. Leyland & Co., Liverpool, acting on behalf of Messrs. Hermann Sturberg & Co., of New York, and she is the third steamer that Messrs. Russell have built for that firm. Like the former vessels, she will be employed in the bulk petroleum trade between America and the Continent. All three vessels have been specially designed for their intended trade by Messrs. Flannery & Blakiston, of Liverpool and London, who have also superintended their construction. The *Charlois* is capable of carrying upwards of 3,500 tons of oil, and is fitted with two very powerful pumps, each of which is capable of discharging the entire cargo in twenty-four hours. She is also fitted with the electric light throughout. To test the speed of the vessel, two runs were made between the Cloch and Cumbrae Lights, a distance of more than 13 miles, and the result was a mean speed of 10 knots, the vessel being brought to her load draught by filling the tanks with water. This result was considered very satisfactory, and as the machinery worked well throughout, the vessel will at once proceed to America to load her first cargo of petroleum. We understand that Messrs. Russell have also in hand a fourth and larger steamer for the same owners.

Correspondence.

[It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—Ed. M. E.]

REDUCTION OF REGISTER TONNAGE BY THE DEFECTIVE WORDING OF THE ENGLISH TONNAGE LAWS.

To the Editor of The Marine Engineer.

Sir,—May I suggest that it would be of great benefit to those of your subscribers who are interested in shipbuilding and owning if you would give in the next number a full report *in extenso* of the trial between the Board of Trade and the owners of the *Isabella*, decided in 1881, as the result of this case has been recently discovered to outrun the accepted interpretation of the Merchant Shipping Acts of 1854 and 1867, so far as the measurement of tonnage is concerned, and it now forms a precedent of the utmost importance, and is therefore of sufficient interest to justify the insertion.

I am, Sir, yours truly,

"CREW'S SPACE."

November 1st, 1888.

The case of the *Isabella* has undoubtedly manifested two very noteworthy defects in the wording of the English Statute Law relating to the measurement of tonnage, and very important consequences have resulted from such defects, owing to the action taken as regards this ship.

Before briefly pointing out the essential particulars of this case in connection with our correspondent's inquiry, it is advisable to state a few words concerning the system of tonnage measurement as provided by the Merchant Shipping Act of 1854, which adopts the method recommended by Mr. Moorsom, who was its first administrator.

Gross tonnage, firstly, consists of the tonnage of the space below what is called the tonnage deck, which is the second deck counting from below; this is obtained by an exact measurement of the inside volume of the ship and by dividing its cubic feet contents by 100 for tons. The space or spaces between the tonnage deck and the uppermost continuous deck are afterwards measured in addition to any spaces above the uppermost deck permanently covered and closed in and available for cargo stores or for the berthing and accommodation of passengers and crew, with an exception to be subsequently mentioned. In each case the interior cubic contents in feet is divided by 100 for tons. The amount of all these constitute the gross tonnage of the ship. In a steamer the spaces occupied by the engines and boilers and shaft trunk are measured, and likewise the span above the engines and boilers framed in for the admission of light and air to the engines and boiler-rooms. The sum of all such machinery spaces is called the "actual engine room" in the Merchant Shipping Acts. After ascertaining the tonnage of the "actual engine-room" the next process is to find out its percentage on the gross tonnage. In a screw steamer if the "actual engine room" exceeds 13 and is under 20 per cent. of the gross tonnage the allowance made from the tonnage on account of the propelling power is 32 per cent. of gross tonnage. If the "actual engine room" is not more than 13 per cent. of the gross tonnage the allowance is 1¾ times "actual engine room." If, however, the "actual engine room" is 20 per cent. or more of the gross tonnage, the allowance is at the option of the owner, 32 per cent. of gross tonnage or 1¾ times "actual engine room." As the latter is the larger the owner generally takes it. According to a contemporary "to make this clearer we put it into figures: A ship is 3,000 tons gross and her 'actual engine room' measures 390 tons, that is just 13 per cent. of the gross tonnage, the allowance is 1¾ times 390 or 682·5 tons. If the 'actual engine room' measures 391 tons the allowance is 32 per cent. of the gross tonnage, that is 960 tons. If the 'actual engine room' is increased till it becomes 600 tons (*i.e.*, 20 per cent. of 3,000), the allowance is still only 960 tons, but make it 601 tons and the allowance is 1¾ times the 'actual engine room,' that is 1,051·75 tons. Thus we see that in certain circumstances in a 3,000 ton ship a difference of a ton in the 'actual engine room' may alter the net register tonnage by 277 tons." The law for measurement of the "actual engine room" makes special provision against unduly increasing its length in order to obtain a more spacious allowance, but the draughtsmen of this law have left a loophole in the 1854 Statute which empowers the designers of a ship to greatly increase the dimensions of her "actual engine room" at a small cost and with no sacrifice of cargo space.

That portion of the Merchant Shipping Statute of 1854 which points out the method of measurement of the "actual engine room" states as follows, viz.:—

"Measure the mean depth of the space from the crown to the ceiling at the limber stroke; measure also three, or if necessary, more than three breadths of the space at the middle of its depth, taking one of such measurements at each end and another at the middle of the length; take the mean of such breadths, measure also the mean length of the space between the foremast and aftermast bulkhead or limits of its length, exoluding such parts, if any, as are not actually occupied by or required for the proper working of the machinery. Multiply together these three dimensions of length, breadth, and depth, and the product will be the cubical contents of the space below the crown, then find the cubical contents of the space or spaces, if any, above the crown aforesaid, which are framed in for the machinery or for the admission of light and air, by multiplying together the length, depth, and breadth thereof; add such contents to the cubical contents of the space below the crown, divide the sum by 100, and the result shall be deemed to be the tonnage of the said space." The rule then declares that if there is more than one engine or boiler compartment, each compartment is to be dealt with as before stated, and their sum obtained, and that the shaft trunk is to be measured and its contents added.

Now, in the opinion of the original framers of this law, and in that also of those who administered it for many years, it was understood in particularising the measurement of space above the crown, &c., to refer to spaces between the upper part of the

engine-room proper and the upper deck of the ship, or the deck of the closed in bridge-house or poop. This space was necessary for light and air or for funnel casing, and was so much deducted from the useful cargo or bunker space of the ship, while it had at the same time been included in the gross tonnage. It was, however, claimed by the London and North Western Railway Company, in respect of their paddle steamer, the *Isabella*, that in addition to the contents of engines and boiler spaces, measured *plus* 50 per cent. (under subsection (*b*), section 23 of the Act of 1854), a further deduction should be made of the contents of the engine-room skylights and boiler casings above the deck, *plus* 50 per cent. thereon, although such contents had not before been measured and included in the gross tonnage. This construction of the law was resisted by the Board of Trade as being antagonistic to the spirit of the 1854 and 1867 Merchant Shipping Acts, but the Board agreed to refer the subject in dispute as a special case for the High Court of Justice. The claim of the company was confirmed, and the net tonnage of the *Isabella* stood in 1881 at 337·90 tons, as against 830·85 gross tons. In the Report of the Royal Commission on the Measurement of Tonnage in 1881, it is said in this part of the question that "the principle on which the tonnage laws were administered until the case of the steamship *Isabella* arose was, that in making deductions from the gross tonnage, the contents of spaces never included in the gross should not be measured for the purpose of being deducted from it. From 1854 to 1879 this principle appears to have been asserted by the Government, acquiesced in by the British shipowner, and adopted by every maritime country of importance; and in accordance therewith the Board of Customs first, and the Board of Trade afterwards, instructed their surveyors that spaces above the uppermost deck, such as cabin and engine room skylights, cabin companions, funnel casings and ventilating places, being places which are not suitable for the berthing or accommodation of passengers or crew, nor the carriage of stores or cargo, should be disregarded altogether in the same way that the funnel is disregarded, and is not included in either the gross or the register tonnage. Acting, however, in the decision in the *Isabella* case, certain spaces above the uppermost deck, though not included in the gross tonnage, are now measured so that their contents may form a deduction from the tonnage to be arrived at by the measurement of under-deck spaces; and that is not all, as in the case of the engine-room skylight, airboxes, and ventilating spaces, not only the contents of the space itself, but half as much again is deducted from gross tonnage. We are satisfied that such a construction of the Acts is due only to defects in expression, and that it is inconsistent with the principle and intention of the law as well as with justice and convenience. Those of the commissioners who held opinions opposed to the majority signed separate reports. These gentlemen include Mr. Rothery, Mr. John Glover, and Mr. B. Waymouth. Although the Royal Commission of 1881 recommended a change in the working of the law that would secure the carrying out the tonnage rules in the manner they were originally understood and intended by their framers, no alteration of such law has yet been made. In measuring a ship for registry we are informed that the Board of Trade surveyors do not measure the funnel casing, etc., above the uppermost deck unless they are specially instructed to do so in each case, but shipowners are enabled to obtain a special order on the subject by applying to the Board of Trade and requesting that the ship referred to may have her engine-space above deck measured according to the decision in the *Isabella* case.

It will at once be noticed that from what has previously been stated respecting the rules governing the allowance for propelling power, that when the "actual engine room," without the above deck spaces, is less than 13 per cent. of the gross tonnage, and the tonnage of the spaces above deck is sufficient to bring it even 13 per cent., the result is a great reduction of the register tonnage. When the percentage, exclusive of the casings, is just under 20 per cent. there is also a slight gain, but when the engine-room, without the above deck spaces, is just over 13 per cent. of the gross tonnage and the space above the deck is not enough to bring the total "actual engine room" above the 20 per cent. limit, the shipowner gains nothing. The special certificate for Suez Canal tonnage is not affected by the change in the British register tonnage of the ship.

Some very important evidence was given before the above mentioned Royal Commission by Mr. Thomas Gray, Assistant Secretary of the marine department of the Board of Trade, a member of the Commission, and who was the first witness examined. He also adduced a great number of important documents and papers relating to tonnage measurement, copies of which appear in the appendices to the minutes of evidence given before the Commission. From the information notified by Mr. Gray an excellent account is given of the law and regulations relating to this question.

What has previously been stated applies to screw steamers only, but the case as regards paddle steamers is similar in principle, as the figures merely differ. For example, if in a paddle steamer "actual engine room" is 20 or less than 20 per cent. of the gross tonnage, the allowance is 1½ times "actual engine room." If, however, the "actual engine room" exceeds 20 but is below 30 per cent. of gross tonnage, the allowance is 37 per cent. of gross tonnage. If the "actual engine room" is 30 or more than 30 per cent. of the gross tonnage then the allowance is either 1½ times "actual engine room" or 37 per cent. gross tonnage, at the option of the owners. A similar rule prevails for the measurement of the "actual engine room" in paddle as in screw steamers, and what has been stated as to space above deck respecting the latter also applies to the former kind of ships.

According to the Statement of Claim delivered in the action referred to by the London and North Western Railway Company the more interesting particulars as to the construction of the *Isabella* is as follows:—"The *Isabella* has two decks, and her upper or tonnage deck is 254$\frac{3}{10}$ ft. long. Her tonnage span solely occupied by and necessary for the proper working of her boilers and machinery is above 30 per cent. of her gross tonnage. A portion of the engine room and the two boiler casings of the *Isabella* project above her tonnage or upper deck. The height of such portion of the engine room above the tonnage deck is 7 ft. and the height of each of the boiler casings above the tonnage deck is also 7 ft. Such portion of the engine room and the boiler casings are roofed in and protected. Between the upper portion of the engine room, so projecting as aforesaid, and the aft boiler casings are placed the galley and the engineer's cabin. Both the cabin and the galley project above the tonnage or upper deck to the height of 7 ft. Both the galley and engineer's cabin are roofed in and protected. . . . In addition to her two decks the *Isabella* has a bridge or deck covering stretching the whole width of the vessel and resting on the top of the said upper portion of the engine room and the casings of the boiler, and is fitted on to the sides of the vessel. The deck covering in this way forms a covering and roof to the upper portion of the engine room and the boiler casings, thereby protecting the machinery and the boilers. The deck covering is also fitted with a skylight over the engine room for the admission of light and air into the engine room. The deck coverings open at both ends, and the engine room is ventilated by openings or apertures underneath the bridge or deck covering. In addition to the engineer's cabin and the galley there are above the tonnage deck of the *Isabella* other closed in spaces solely appropriated for the berthing of the crew. The aggregate of such closed in spaces, including the engineer's cabin and the galley, does not exceed one-twentieth of the remaining tonnage of the steamer ascertained, as directed by the 21st Section of the Merchant Shipping Act, 1854. The arrangements of the *Isabella* comply with all the requirements of Section IX. of the Merchant Shipping Act, 1867, as regards deduction for crew space."

The other significant defect in the wording of the Statutes relating to the measurement of tonnage is that respecting the allowance on exemption of crew space. The Merchant Shipping Act of 1854 stipulates as regards spaces above the upper deck of the ship that, "If there be a break or poop or any other permanently closed in space on the upper deck available for cargo or stores, or for the berthing or accommodation of passengers or crew, the tonnage of such space shall be ascertained as follows." . . . . [Here follows the rule of measurement to obtain the exact cubic contents which need not be particularised] . . . . "and shall be added to the tonnage under the tonnage deck, ascertained as aforesaid, subject to the following provisoes: First that nothing shall be added for a closed in space solely appropriated to the berthing of the crew, unless such space exceeds one-twentieth of the remaining tonnage of the ship, and in case of such excess, the excess only shall be added."

It will be seen that crew space is allowed by the 1854 Statute, as an exemption and not as a deduction, as it is only permitted when it is above the upper deck. The Act also only allowed the space which is used for actual berthing and not for berthing and accommodation combined, consequently no exemption was permitted for mess-rooms, but merely for space in which the crew or officers (for officers are, with the exception of the masters, included in the crew) were actually berthed. There is a clause in the Merchant Shipping Act of 1869 which enacts that all spaces for the accommodation of the crew should be ventilated, lighted,

drained, &c., and that on the registry or re-registry of any ship these spaces should be inspected by a surveyor, and who, if properly fitted and marked, should give a certificate to this effect to the Collector of Customs, and then according to that statute, "such space shall be deducted from the register tonnage." This provision was evidently intended to supersede the exemption of crew space mentioned in the 1854 Act, and was understood to do so for some years subsequently by all concerned. By the Merchant Shipping Act of 1867, however, owing to the oversight of the draughtsman, no formal repeal clause was inserted. The owners of the *Isabella* took advantage of this omission, and the consequence was that it has been conclusively decided that spaces above the uppermost deck, wherein the crew are berthed, may firstly be exempted from measurement in the gross tonnage by the 1854 Statute, and then deducted from it by the 1867 Act.

The surveyor of the Board of Trade still acts upon their old interpretation of the tonnage law in measuring ships, but if a shipowner applies to the government department for an exemption of the crew space above deck, under the decision in favour of the *Isabella* a special order is issued by the Board and the alteration is made accordingly.

It has been said that no sailing vessels have yet obtained this exemption though it is also applicable to them. Such exemption does not affect the tonnage on which dues are levied in going through the Suez Canal, or in the Danube. When steamers are sold or chartered on their gross tonnage, as they frequently are, the last mentioned exemption, which lowers the gross tonnage, is a disadvantage to their owners.

An immense mass of evidence was given by leading officials connected with various branches of the shipping industry as to the advantages or disadvantages of different systems of tonnage measurement before the recent Royal Commission on this subject, which is well worthy of notice to shipowners.—Ed. *M.E.*

WASTING AWAY OF CONDENSER TUBES.

To the Editor of The Marine Engineer.

Dear Sir,—I ask your permission to bring the following before your numerous readers, and perhaps some of them can state the cause and give a remedy or cure.

A pair of compound surface-condensing engines, of about 130 N.H.P., in a general trading steamer, have, through the condenser, caused a great deal of trouble and expense by the wasting or eating away of the condenser tubes from some inexplicable cause. The tubes have been renewed twice in five years. After renewal all goes well for about six or seven months, and then the tubes fail, sometimes as many as three or four requiring to be fitted in each port of call. The tubes are plain brass, not tinned, and at the discharge ends, almost within the ferrules (which are wood), the tube is eaten through—this occurs in the *discharge ends* of the tubes only. The condenser is in two divisions, the condensing water travelling first through the bottom part, and then through the upper half overboard; the ends where the water *leaves* the bottom division of tubes and the ends where it *leaves* the top, are the only parts affected, and the whole corrosion or wasting is confined to within three inches of the end of the tube.

The water is driven through the condenser by the ordinary circulating pump.

I would feel very much obliged if any of my brother engineers who have met with the same trouble will kindly say what they believe to have been the cause, and what remedy did they use.

I am, yours truly,

Belfast, 14th Dec., 1888. A MARINE ENGINEER.

[We have received from the writer of the above a specimen of the end of one of the tubes alluded to, the ferrule being left on. We shall be pleased to show this to anyone interested on calling at this Office.—Ed. *M.E.*]

REVOLUTIONS OF STEAMSHIPS.

To the Editor of The Marine Engineer.

Sir,—A few years ago before the introduction of the triple-expansion engine, the revolutions were generally from 60 to 70 per minute in ordinary steamships. Now we have the same class of ships making the same speed with 30 per cent. more revolutions. If it is not to increase the N.I.H.P. would some reader kindly say why is a propeller of less pitch used? Would it not save a great deal of tear and wear, and considerably reduce the consumption to run the engines at their old speed?

Hoping for an answer, I remain, Yours truly,

R. C.

Reviews.

Calvert's Mechanics' Almanac for 1889. By Wm. Calvert. Manchester: John Heywood.

We have now before us a copy of this most useful almanac for 1889, the sixteenth year of publication.

The present issue compares very favourably with its predecessors, both as regards the quantity and quality of the information contained in its sixty odd pages.

A full page illustration of, and a well written article on, the "Exhaust," injector, together with a full explanatory article on "Turning Cones or Tapers," also illustrated, are each alone worth more than all the money charged for this most handy and useful little book. Another useful contribution is by Mr. Wm. Ward on "Angle Measuring with a two-foot rule." This article is accompanied by a table showing the distance it is required to open a two-foot rule for any given angle from 1 to 90 degrees, the advances being made by half degrees.

A series of hydraulic memoranda, useful information for engineers, etc., complete the literary portion of this popular publication.

Transactions of the Institute of Naval Architects. Vol. XXIX. London: 5, Adelphi Terrace. Edited by George Holmes, Esq., Secretary of the I.N.A.

Undoubtedly the year which has just drawn to a close has been one of solid progress, so far as the kindred branches of naval architecture and marine engineering are concerned, and judging by the goodly volume of transactions now before us it seems to have fared well, both as regards addition to its numbers and importance of papers submitted, with the Institution of Naval Architects during the year of grace, 1888.

If only because of its containing the two far-seeing presidential addresses the present volume of transactions would form a worthy compeer with its predecessors, while for importance of subjects touched upon and masterly handling of the same by the respective contributors of the papers, the transactions for 1888 leave nothing to be desired.

As most of these papers have already appeared *in extenso* in our columns a mere repetition of their titles here must suffice.

"The Application of Hydraulic Power to Naval Gunnery" was a most valuable contribution on the subject, and was given by the Right Hon. Lord Armstrong and J. Vavasseur, Esq., during the proceedings at Newcastle in 1887. This paper is well illustrated by some very finely executed scale drawings, thirteen figures in all being given. The next paper in the volume, "Progress and Development of the Marine Engine," was fully reported in our pages at the time. Following this we have two very interesting papers, viz., "On some Recent Experiments with Basic Steel," by W. H. White, Esq., and "On the Present Position occupied by Basic Steel as a material for Shipbuilding," by B. Martell, Esq. The foregoing papers, together with a "Description of the Improvements of the River Tyne," by P. J. Messent, Esq., brought the proceedings at Newcastle to a close.

Coming now to the proceedings in London we find the following interesting papers (many of which have already been given in full in these pages) were read and discussed:—"On American Warship Design," by W. John, Esq.; "On Unarmoured Water-line in Warships," by Capt. C. C. P. Fitzgerald, R.N.; "The Development of Modern Weapons considered in relation to the Designs of Warships," by Capt. H. Grenfell, R.N.; "Working and Test Pressures for Marine Boilers," by R. Sennett, Esq.; "On the Possible Advantage of using highly Volatile Liquids in Lieu of Water for the Purposes of Propulsion," by A. F. Yarrow, Esq.; "On the Fineness of Vessels in Relation to Size and Speed," by Mons. J. A. Norman; "On a Method of Approximately Determining the Mean Girth of a Ship," by A. Blechynden, Esq.; "On Forced Draught," by J. R. Fothergill, Esq.; "Boilers under Forced Draught on the Closed Stokehold System," by T. Soper, Esq.; "On the 'Constant' System of Notation of Results of Experiments on Models used at the Admiralty Experiment Works," by R. E. Frank, Esq.; "A Theory of the Screw Propeller," by Professor A. G. Greenhill; "Communication Relating to the Results of Experiments with Four- and Two-bladed Screw Propellers," by J. B. Andreæ, Esq.; "On Proposed Designs for Surface-boats and Diving-boats," by Lieut. Hovgaard, Royal Danish Navy; "On the Material best suited for Propellor Blades," by W. Wallace, Esq.; "Notes on the Influence of Size and Speed on Collisions at Sea," by J. H. Heck, Esq.

This goodly list of useful papers, together with the usual formal business transactions, brings to a close one of, if not the most, interesting volumes of transactions yet put forth by the Institution of Naval Architects, and, in common with all connected with the Institution, we can but here record our appreciation of the very satisfactory manner in which the (by no means light) editorial duties of seeing the volume through the Press have been accomplished by the indefatigable secretary of the Institution.

Obituary.

THE LATE MR. JOHN McMILLAN, JUN., SHIPBUILDER, DUMBARTON.

IN the death of this gentleman, which occurred at Mentone on the 2nd ult., the town of Dumbarton has lost one of its most energetic leaders of industry, and the shipbuilding profession a worthy member.

Mr. McMillan was a son of Mr. John McMillan, senior partner in the firm of Messrs. Archibald McMillan & Son, Dockyard, Dumbarton, whose business dates so far back as the year 1834. The deceased was born at Dumbarton in 1848, and was thus only in his fortieth year. Never of a very robust constitution, he was prostrated some years ago with a severe attack of rheumatic fever, from which it is thought he never quite completely recovered. About the middle of last year he was attacked by his old enemy, but rallied sufficiently to justify a hope that in milder climes his health might be re-established. Although the change had at first a beneficial effect, it was ultimately found that the disease had assailed the heart, and a serious relapse ensued. The fears this gave rise to were too soon realised, and on the 2nd ult., as already stated, the deceased gentleman passed away in his fortieth year. Mr. McMillan was born and brought up in Dumbarton, and at an early age evinced a decided talent in ship design. Thus, while his elder brother, Robert (who some two and a half years ago seceded from the firm), engaged with his father—who still survives—in the conduct of the practical affairs of the shipyard, the deceased occupied himself in securing the contracts for new vessels, and in fixing the dimensions and form which these vessels should assume. In the year 1877 he designed and exhibited at the [competitive exhibition of ships' models, held in the Fishmongers' Hall, London, under the auspices of the Worshipful Company of Shipwrights, a beautifully-finished model of a full-rigged sailing ship, for which he was awarded the first prize, consisting of a gold medal, together with the freedom of the City of London. The award was afterwards amply justified in the achievements and beautiful appearance of the clipper *Coriolanus*, built on the lines represented by the model in question. In 1882 Mr. McMillan was again successful in carrying off first prize in a competition held under the same auspices, with a model representing the sailing ship *Imberhorne*, then being built by Messrs. McMillan at Dumbarton. The prize in this case again was a gold medal, and, in addition, Mr. McMillan was shortly afterwards admitted as a member of the Court of the Worshipful Company of Shipwrights, a guild whose early history is lost in antiquity, and whose membership, past and present, embraces almost all who have notably contributed to Britain's supremacy as a shipbuilding nation.

The deceased gentleman was also a member of the Institute of Naval Architects, but took little share in that society's deliberations. The firm with which he was identified achieved a vast amount of creditable work, principally connected with the production of sailing ships. It was by this firm that the system of cellular bottom construction for water ballast was first introduced into *sailing ships*, and it was largely through their readiness to adopt mechanical in place of manual power for the riveting of ships' hulls that the system of hydraulic machine riveting is now so prevalent in the largest shipyards. The deceased, for a considerable time before his death, had the full responsibility of the firm's extensive business (Mr. J. McMillan, senior, having practically retired from active business for several years), but latterly a manager had to be engaged in order to relieve him of the cares and duties of the shipyard. The gentleman secured for this position was Mr. J. Steele, of the old-established shipbuilding firm of that name, and this gentleman has since been assumed a partner in Messrs. McMillan's business.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from November 16th to November 23rd, 1888.

16628 W. H. & J. Chambers. Life boats.
16655 T. P. Willcox. Saving life from drowning.
16678 J. Straker. Propelling boats.
16683 W Snelling. Valves.
16693 T. Nordenfelt. Torpedoes.
16706 B. W. Moughan. Screw propellers.
16717 W. P. Hoskins. Folding lee rail of ship's berths.
16720 A. J. Cooper & E. E. Wigzell. Taking soundings.
16723 G. A. Poole. Propelling ships.
16733 J. T. Niblett. Preventing incrustation in boilers.
16754 P. A. Guion and J. T. Knight. Feed-water heater and purifier.
16760 H. H. Grenfell. Lights for ordnance.
16761 R. Reichling. Steam condenser and heater, and purifier of feed water.
16783 E. Seedhouse. Anchors.
16790 J. Atkinson. Steam engine indicators.
16795 Day (P. S. Swan). Stop valve and regulator.
16802 J. Walsh. Ship and boat saving appliances.
16810 Tangyes (Limited). T. Jefferiss and C. W. Pinkney Lubricators.
16840 W. M. Brown & S. W. Whitmore. Steam generators.
16853 D. B. Morison. Fire bars for marine boiler furnaces.
16858 A. F. Craven, W. Pinder, & P. H. Stansfield. Injector and ejector stop tap.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1 C, denotes First Class; 2 C, Second Class.

November 24th, 1888.

Allan, James	1C	Glasgow
Anderson, T. R.	2C	,,
Bailey, T. W.	1C	London
Binnie, C.	2C	Glasgow
Braithwaite, C.	2C	W.H'pool
Brundrit, J.	2C	Liverpool
Carefull, T. J.	1C	,,
Coutts, W.	1C	Aberdeen
Crathorne, R.	1C	Sunderl'd
Cummings, F.	2C	Hull
Dewar, A.	2C	Glasgow
Dingwall, J.	1C	Dundee
Edmiston, R.	1C	Glasgow
Ferguson, Wm.	1C	,,
Gibson, F. R.	1C	London
Girdwood, J.	2C	W.H'pool
Gordon, W. C.	1C	Dundee
Guild, J.	2C	,,
Herriot, J. S.	2C	London
Jones, M.	2C	Liverpool
Jones, R. O.	1C	,,
Kenna, G. W.	2C	,,
Linton, J. W.	1C	Sunderl'd
Mann, J. B.	2C	Liverpool
Marchant, C. E.	2C	London
McClelland, T.	2C	Glasgow
McDonnell, H.	2C	W.H'pool
McNaughton, J.	2C	Liverpool
Morrison, A.	1C	Glasgow
Morgan, D.	2C	London
Munro, G.	1C	,,
Neill, J. R.	1C	Sunderl'd
Ramsay, W. E.	2C	London
Robertson, S. G.	1C	Sunderl'd
Shanks, A.	1C	Glasgow
Smith, J. G.	1C	S. Shields
Stamp, T.	2C	W.H'pool
Taylor, A.	2C	Sunderl'd
Walker, A.	2C	Glasgow
Wright, J. W.	2C	Liverpool
Wyness, G. T.	2C	Aberdeen

December 1st, 1888.

Corkhill, John	2C	Liverpool
Elliott, Wm.	2C	,,
James, S. F.	2C	Plymouth
Murdoch, Geo.	2C	S. Shields
Rutherford, G. R.	2C	,,
Scott, Hy. John	2C	Liverpool
Sopwith, J. D.	2C	N.Shields
Vincent, Geo. L.	1C	Plymouth
Wardman, J. C.	1C	S. Shields
Warriner, H. J.	2C	Liverpool
Watt, John	1C	,,
Webb, F. W.	2C	S. Shields
Wilson, Geo.	1C	Liverpool
Wilson, J. W.	2C	Sunderl'd

Erratum.—In our notice of the launch of the *Peninsular* (vide p. 322 of last issue) we inadvertently stated that the cooking ranges were supplied by Messrs. Benham & Sons, of London. We are now informed that these ranges were not supplied by the firm named, but by Messrs. Ridsdale & Co., of the Minories, who also have in hand the ranges for the *Oriental*, *Bombay*, *Shanghai*, *Ceylon*, and *Hong-Kong*, now building by Messrs. Caird & Co. We regret that the error should have occurred, but as the information was supplied from what we considered a competent local source we used it in all good faith.

The Marine Engineer.

LONDON, FEBRUARY 1, 1889.

ALTHOUGH for nearly a year past shippers and shipbuilders have had a stream of prosperity to which they have been unaccustomed for the prior four or five years, considerable anxiety is now being shown that the improvement in freight should not lead to too hasty a glut of new tonnage, which would but throw the freight market into its former unsatisfactory condition. It appears from the returns of the principal shipbuilding centres that about 800,000 tons have been constructed during 1888, which is a larger tonnage than has been launched in any previous year since 1883. About 90 per cent. of this total tonnage is now steam propelled, and is capable of carrying upwards of 14 millions of tons, assuming an average length of voyage and ordinary activity. As regards the glut, however, of the shipping market, it must be remembered that of this annual output a considerable part is merely to replace losses for the maintenance of the present fleet, and thus that only a small part of this increase has the effect of an addition to the total carrying capacity of our commercial marine. As also the volume of trade of the world is, in spite of all checks, rapidly increasing, there will be good reason to expect plenty of employment for the constantly increasing tonnage. Of the present commercial fleet of the world, a large proportion of the ships of other nations is still sailing tonnage, which is likely to be more and more replaced by steam tonnage, and much of the older fashioned steam tonnage is now out of date, as compared with steamers carrying most modern improvements, and must therefore be replaced. Further than all this, however, it is found by statistics of the shipbuilding trade that Great Britain takes from year to year a more prominent position in the carrying trade of the world over foreign countries. About 33 per cent. of the total amount of increase in the foreign trade has fallen to the United Kingdom. Thus the foreign market for the employment of British tonnage is also steadily on the increase, besides the ordinary increase of our home trade. It is a startling fact to realise, that in addition to carrying over three-fourths of the whole of our enormous foreign trade from home ports, we carry about one-half of that of the United States, Holland, Italy, Russia, and Portugal, more than one-third of that of France and Germany, and nearly one-fifth of maritime countries such as Norway and Sweden. An increase in tonnage in foreign countries to meet the growth of trade is only represented by the United Kingdom, Germany, Russia, and Portugal, the other countries showing marked decreases in the last ten years, so that, on the whole, British bottoms have realised the benefit of the whole increase of carrying trade for the world in the last ten years. There is thus every reason to believe that there is good margin beyond the mere increase of trade in Great Britain to occupy a considerable further increase in tonnage.

THE criticisms upon our English Naval administration are oft repeated, and seem to outsiders to be of a very serious character, so it is somewhat refreshing to find that our British Naval administration can be held up as worthy of attention and imitation by our close neighbours, the French. This we gather from a volume lately published in which are collected and annotated a series of letters by Monsieur Paul Bourde, entitled, *Les abus dans la Marine*. The statements therein published are very carefully compiled so as not to exaggerate beyond clearly proved facts, but are so startling in their character, that one might well hesitate to accept them were they not all so carefully substantiated by facts and figures from official documents, or from public utterances of Ministers. This conclusion seems indeed to be that, as it is at present organised, the navy of that country is nearly as useless as it is costly. There seems to have been no reorganisation to any extent since 1844, as two special Commissions in 1849 and 1878 appear to have produced no effect by their reports, owing, in the first case, to the *coup d'état* immediately following, and in the second case to the death of one member, and the resignation of another. Some of the chief facts may be summed up as follows: — Although France may be considered to have a navy second only in importance to our own, the French Ministry of Marine employs a clerical staff of very nearly twice as many persons as are employed by the British Admiralty. The French dockyards employ 21,000 workmen and 1,930 police, whilst the British dockyards employ only 16,000 workmen and 309 police. Nearly two-thirds of the estimated actual value of the property under control of the French Minister of Marine are invested in works on shore, only one-third being invested in works afloat. In Great Britain the proportions are reversed. Again, France employs 38,000

men ashore to keep 39,000 men afloat, and maintains 3,000 civil functionaries and clerks as against only 1,800 officers. France maintains five naval ports and arsenals, each being very completely supplied with plant for the construction of vessels of wood, iron or steel, and for the getting ready of vessels for sea and the repair of ships of all classes. Each port has a Préfet Maritime, and under him superintendents, commissary-general, directors and inspectors, each of whom has his office and clerks. This organisation being very complete, would be very creditable to the nation were there the slightest possibility of their effectiveness for the production or maintenance of the navy in case of war. But this is scarcely so, for at Rochefort, for instance, where there are enormous iron works, capable of turning out battle-ships of the largest size, the river Charonte is so shallow that large-sized ironclads could not be got to sea. This would, then, render this port practically useless for either building or repairing the larger ironclads. The same criticism may be applied to Lorient, where the port is too small to admit of the preparation for sea of a modern squadron. The establishments are thus generally greatly more expensive and more numerously served than the nature of the work to be accomplished by them, or the facilities of their positions, would warrant, and as the accommodation and many of the staffs are rather on a war footing than on the present peace footing, there is everywhere idleness, and not sufficient work to keep the establishments going. As a consequence, what work there may be is so nursed and kept on hand, that the vessels are often obsolete before they are launched; as, for instance, the battle-ship *Brennus*, building on the stocks at Lorient, had only one-twenty-fifth of the work done in four years, at which rate she would have been ready for sea only in 100 years. The work has been, however, suspended, and again ordered to proceed on new plans, the work done on the old plans being sacrificed. In another instance £60,000 had to be spent in an alteration of the machinery of a battle-ship before she had ever been afloat. All work in the dockyards is paid by the day and not by the piece, and many years ago an experiment on this point was made as to what a man could earn by piece-work on the production of copper nails, in comparison with what he had been in the habit of receiving. Paid by the day, he received 2 f. 60 c., paid by the piece at the same rate as per time work, he earned 4 f. 20 c., but in spite of all these glaring evidences of costliness of work and general inefficiency, no alterations have as yet been made. The true secret of this extravagance appears to be to keep the staff of men on practically a war basis, and Ministers have often candidly confessed that the people in the yards were given absolutely useless and puerile work in order that they might have resemblance of occupation. Instead of a minimum stock of, say, one year's surplus of stores being maintained, there are in the French arsenals stocks for 10 to 30 years' supply, with a consequence that they are more or less obsolete, and cost a considerable annual charge by deterioration from stocking, constant sales being necessary of surplus stores, which fetch about one-fourth of the outside market price. This system of wasteful expenditure seems to apply to the purchase of all commissary stores as well as to material, the stores being manufactured and charged to the navy at 30 to 40 per cent. above outside market prices. All this must be sad news for the French Administration, and is perhaps some consolation to ourselves, that faulty as our organisation may be, that of foreign countries seems to be as bad, if not considerably worse.

In spite of the importance of engineers for the efficient manipulation and fighting maintenance of the modern ironclad, their claims to recognition as of equal importance to their brother executive officers does not yet appear to have been properly recognised. If economy is required in the fighting staff of the Navy, the engineers seem to have to bear the brunt of such economy by the substitution of artisan and cheap labour for the engineers of a higher grade, education and position. Their possibilities of advancement in the commission grades are barred considerably as compared with the openings offered to their brother officers, and the consequent rate of remuneration is, therefore, on a much less satisfactory scale than that of the other branch of the Service. We can only suppose that the eyes of the Admiralty will scarcely be fairly opened until a great naval war shall point out that without an efficient and skilful engineering staff, massive ironclads and swift cruisers become but helpless coffins on the face of the ocean. Where, moreover, it might be necessary to obtain a desired position before battle, it will no longer consist in the skilful manœuvres of the admirals or captains of the Fleet to take advantage of the weather gauge, or other conditions of the weather and position, but will be simply and wholly a

question of the construction and working of the engines to be capable of prolonged effort at a maximum speed. Battles will probably be determined more frequently by the injury or breakdown of the complicated machinery on board than by the warlike skill, or efforts of departments controlled by the executive officers. The power of ironclads to remain at sea as cruisers, or for offensive operations against a hostile coast, will depend on economy of fuel at the right time to maintain the stock and the perfect action of the engines and boilers, all distinctly appertaining to the engineers' department. We regret deeply on their behalf that their claim to relative rank and remuneration should still remain in such an unsatisfactory position, though we trust that constant agitation may at last wear away old traditions and obtain proper recognition for the present altered state of affairs. Should this prove for some years unsuccessful we can only suggest, that as there is no doubt as to the importance of the functions and responsibility of this part of the duties of a naval staff, sooner or later a crisis will come, by which this claim for recognition will be forced upon the authorities, as all things sooner or later find their market value.

LAUNCH OF THE WHITE STAR ROYAL MAIL STEAMER, AND MERCANTILE ARMED CRUISER, "TEUTONIC."

TEMPORA *mutantur et nos mutamur in illis*, may well exclaim the shipowner of our day, as he thinks with a lingering feeling, akin to regret, of how great the change in the character of steamships in recent years, and how short a time has been required to accomplish it.

In May, 1875, the *Germanic*, the latest addition to the White Star Atlantic fleet, took her station on the Liverpool and New York service of the Company, and, with her sisters which had preceded her, completed a fleet unequalled then or since for uniformity in design and efficiency, the White Star Line retaining its position for several years as the swiftest on the Atlantic.

As illustrating the regularity of their passages, it is worthy of note that in 1876 the *Britannic*, twin sister to the *Germanic*, averaged for six voyages outwards, 7 days 18 hours 26 minutes; and six voyages homewards, 7 days 20 hours 56 minutes; a considerable advance as it appeared in those days upon the 10 or 12-day passages which were then the rule.

In 1877, on her twenty-second voyage from Queenstown to New York, the *Britannic* crossed in 7 days 10 hours 53 minutes, then the fastest ever accomplished, and she excelled this in 1887, when she travelled from New York to Queenstown, on her 117th voyage, in 7 days 9 hours 40 minutes. With steamers so far in advance of their competitors, the White Star Line has since 1874, so far as their New York fleet is concerned, remained quiescent, content with the type which they had adopted, and they have seen the great fleets of the world rebuilt to attain greater speed, with varying success, upon the lines of the type laid down for the White Star Company, through the skill and foresight of Sir Edward Harland and his firm (Messrs. Harland & Woolff), in 1868. Formerly this type of ship with its long, graceful lines, four masts, minute subdivision by water-tight compartments, saloon near the centre, forward with revolving chairs, separate decks for the different classes of passengers, and accommodation replete with comfort for all, was *sui generis*. Now, however, it stands amongst many competitors who have equalled, and, in the matter of speed, outstripped it to an extent which has compelled Messrs. Ismay, Imrie & Co., the managing owners of the White Star Line, to decide upon another forward movement.

Eight years ago the outlines of a new and advanced type of ship were agreed upon, but for eight years the owners have held their hands, conscious of the superabundance of tonnage which was in the trade. But circumstances in the meanwhile had changed, and showed conclusively that the time had arrived when, unless the Company was prepared to see itself dropping behind its competitors, a long step forward must be taken and the work of construction commenced. The well-matured plans for twin screw steamers were therefore put in hand in the middle of 1887.

It can scarcely be expected that an advance could be made a second time so great as that marked in 1870 with the *Oceanic*, whereby, as acknowledged by shipbuilders and naval architects, was inaugurated a new era of comfort, combined with enhanced safety and speed, in ocean travelling, which has reached such surprising developments to-day. But through the experience gained and the improvements which have taken place in Marine Architecture and Engineering much is hoped and expected from the *Teutonic* and her sister ship the *Majestic*, now building in Belfast for the White Star Line by Messrs. Harland & Wolff.

The first of these vessels was launched on the 19th January from the Queen's Island yard, and her career may thus be said to have commenced, all public ceremony at the launch being dispensed with in accordance with the traditions of the White Star Line. Her sister the *Majestic* is still on the stocks, but is expected to be shortly launched and completed in time to bear her part in the work of the summer season. The length of these ships will be 582 ft., constituting them the longest vessels afloat; breadth 57 ft. 6 in., depth 39 ft. 4 in. with a gross tonnage of nearly 10,000 tons. They are being built of Siemens-Martin steel, and will each be propelled by two independent sets of triple-expansion engines constructed by Messrs. Harland & Wolff, driving twin propellers with manganese bronze blades. In form and construction of hull they will possess all the distinctive beauty of outline and strength which characterized their predecessors, the *Oceanic*, *Adriatic*, *Britannic*, *Germanic*, &c., with the addition that, while they are as minutely subdivided by athwartship bulkheads, they are also constructed with a longitudinal bulkhead running fore-and-aft throughout the greater portion of their length, giving additional rigidity and strength to their structure, and greatly increasing the security of the ships in the event of collision. Though similar in hull and outline to the present White Star ships and having two funnels only, the masting of the *Teutonic* and *Majestic* will be different. Three large taunt pole masts, entirely without yards, take the place of the familiar four masts with full equipment of square canvas, which did such good service in the earlier ships, the application of twin screws rendering the larger amount of sail power superfluous. There are, indeed, many nautical men who deem the ship provided with twin screws sufficiently secure without the addition of masts at all, but the owners of the White Star Line, whilst they are conscious of the advantage in speed which might thus be gained, prefer to retain sail power to supplement the engines and so reduce every possible risk to a minimum.

These vessels are not intended to carry an excessive number of saloon passengers. Their limit for that class will be 300, and provision will be made for all this number to dine at one time. There will also be accommodation for 150 second cabin passengers, and about 750 steerage. In the general deck arrangements the characteristics which have so long successfully prevailed will be but little changed, while each class of passengers will find that nothing has been left undone which experience and forethought could suggest for their comfort. There will be the same separation of the saloon and steerage passengers by means of different decks. The single men of the steerage will be in the forward end of the ship; saloon passengers in the centre; the second cabin passengers and the married people and single women of the steerage in the after end—each absolutely divided from the other and enjoying their own promenade decks. In fixing the limit of saloon passengers at 300, Messrs. Ismay, Imrie & Co. have been guided by the extent of the seating accommodation in the saloon, so that all passengers may be served at one sitting, and the necessity for double meals thereby avoided. In treating of the accommodation for this class perhaps the most noticeable

feature is the arrangement by which the main saloon has been placed exactly in the centre of the ships.

The change in the location of the saloon from the stern of the ship over the screw to a place somewhat forward of the centre, which was inaugurated by the White Star fleet in 1868, was productive of greatly-increased comfort, and has since been very generally adopted. In the *Teutonic* and *Majestic* a further effort has been made, and the saloon and sleeping accommodation have been placed in the very middle of the ship, both as regards length and depth, where there is the minimum of movement.

The hurricane or promenade deck will be 245 ft. long with a clear width of 18 ft. on each side of the deck houses, and will be free of all obstruction, the boats being placed on an awning deck on top of this again, which will serve as a permanent shelter in place of the canvas now used for that purpose.

On the promenade deck, besides the usual accommodation for the commander, there will be good state rooms for passengers' use, having direct communication with the decks below. A pantry will be provided for the deck steward to facilitate his attendance on passengers who may be "under the weather," also an entrance to the gentlemen's smoke room, lavatories, &c.

Adjoining the main entrance is the library, containing bookcases filled with a careful selection of literature to satisfy the most exacting. It will be panelled with light oak, the panels carrying a somewhat novel ornamentation, produced by burning the design in a gilt ground, varied at short intervals by a tastefully carved panel with a figure after the best sixteenth century French and Italian work, in low relief. The room will be lighted at the sides by windows covered by glass shutters of Italianesque design, and will be luxuriously upholstered and arranged to afford the maximum of comfort to its occupants.

Passing down, through the main entrance, to the next, the upper deck, one finds, in addition to the purser's quarters, deck state rooms for saloon passengers, furnished with baths, &c. Besides these rooms there will be, on the same deck further aft, the gentlemen's lavatory, the barber's shop, and the first-class smoke-room. The last will be a somewhat special feature in these ships, an effort having been made to do away as far as practicable with the customary somewhat stiff seats of steamers' smoke-rooms, and in their place to substitute comfortably-upholstered couches. The walls of this room will be covered with richly-gilt embossed leather, the design being a careful reproduction of one of the best patterns of the old Flemish Cuir *repoussé*. Panels in the sides of the room will be filled with oil paintings representing shipping from some of its most picturesque aspects—ships of war, old and new, dating from the gaily-decorated vessels of the Venetian Republic and the other great naval powers of the Mediterranean in the Middle Ages. Other spaces will be filled with shallow niches, each holding a figure in high relief, carved in pear wood, after Donatello. The ceiling will follow an old English plaster pattern, in quaint variously-shaped panels, with modelled rosettes at intervals. Shutters of ornamental glass will be arranged to obscure the windows of the room at night.

Retracing one's steps to the main saloon and passing down to the next—the main deck—the principal saloon is entered, which, apart from its size, will present many novelties both in design and construction. In general the decoration is of the Renaissance period, and the prevailing tones ivory and gold. The walls will be pencilled out by shallow moulded framework, highly enamelled, and slightly relieved with gold, whilst the panels in this framework will be executed in a glyptic material in which Tritons, nymphs, and other oceanic symbols appear. The figures in relief will have an ivory-like surface and tint, and the groundwork of the panels will be of gold. The ports will be lined with *repoussé* brass-work of the same Renaissance character as the walls, and will be fitted with stained glass blinds, emblazoned with the arms of the principal states and cities of America, Canada, and Europe, behind which will be placed electric lights so that the brightness of the design will be apparent by night or day. The ceiling, like the walls, will be in ivory and gold, richly ornamented, the electric light being introduced into the ornamentation of the ceiling in place of the usual hanging lamp.

Forward of the saloon and also immediately below it there will be the first-class state rooms. A large proportion of these will be two-berthed rooms only, and so arranged that there will not be both upper and lower berth in the same room. Numerous rooms of large size for families will be provided, as well as rooms suitable for a single passenger only. In every state room an effort has been made to give an attractive and home-like appearance to its furniture by means of easy-chairs, chests of drawers, hanging cupboards, &c., and, as is now almost universally the case, the electric light in each room will be under the control of the occupant and available at will. Ample bath and lavatory accommodation of the most modern description will be provided closely adjoining each section of the saloon quarters; also a good baggage room easily accessible for articles wanted on the voyage. Abaft the main saloon on the one side have been arranged the first-class pantry, galley, baker's shop, scullery, bread-room, and butcher's shop, the last with direct access to the refrigerating chamber immediately below, in which will be kept the fresh stores. In the other side of the ship are state rooms leading aft to the accommodation for the second-class passengers.

The rapid growth of the second-class section of the Atlantic passenger trade has necessitated considerable changes from time to time, and in the *Teutonic* and the *Majestic* an endeavour has been made to provide accommodation of such a character as will beyond doubt compete successfully for this class of business. Comfortable state-rooms in no way inferior to the old-fashioned first-class accommodation, a dining saloon on the upper deck with smoke-room above, a promenade deck set apart for their own use, and good baths and lavatories will all tend to popularize these ships with the most critical of second-class passengers.

The arrangements for steerage passengers have always been a special feature in the White Star steamers, and their excellence is sufficiently attested by the fact that in 1887 more steerage passengers were landed in New York by the steamers of this company than by any other British line.

The complete isolation of the single men and women at each end of the ship, and of the married people in their own quarters in two and four-berth rooms, separate entrances, closets and lavatories for each division, a bath for the women and children, and a smoke-room for the men, have all been arranged for, while the comfortable steerage pantry will enable a constant supply of hot water and other comforts to be maintained for those who need them. In common with all other parts of the ship, the steerage will be lighted by electricity throughout. Such are the outlines of the two great ships, to which will be committed the maintenance of the prestige of the White Star flag, and were anything wanting to stamp the excellence of their qualities, the recognition which they have already obtained at the hands of Her Majesty's Government should be alone sufficient.

Addressing the members of the Institute of Naval Architects on 30th March, 1887, upon the "Merchant Service and the Royal Navy," Sir N. Barnaby, late Director of Naval Construction referred to the arrangements which had then recently been completed between the Admiralty and the White Star and other companies for the retention of their steamers for war purposes, and pointed out that "this seed for which we have to thank Mr. Ismay was planted at the Admiralty nine years ago: . . . . the outcome of proposals made by Mr. Ismay as far back as 1878," when he urged upon the attention of the Admiralty that a fast mail or passenger steamer may be as efficient a factor in a naval war as an ordinary war cruiser, and offered to make an agreement to hold at the disposal of the Admiralty, upon terms then specified, certain ships for the purposes of the State in time of war.

The matter lay dormant until August, 1886, when Messrs. Ismay, Imrie & Co. revived it by offering on behalf of the White Star Line to build two ships to be approved by the Admiralty of a speed and strength superior to any merchant ship afloat, with engines and boilers below water, complete subdivision by bulkheads, fittings for guns built in during construction, and manned by half crews of naval reserve men. An agreement was come to and the plans for these ships were submitted to and approved by the Admiralty from their very inception, and the progress of the work has been watched by practical advisers of the Admiralty to the present time.

When complete the *Teutonic* and *Majestic* will be so arranged that twelve guns can be mounted on each ship 48 hours after arrival in port, and it is believed that, with their attributes of twin screws, high speed and great strength and coal endurance, these two steamers will play an important part in realizing the hope of many in times past of seeing the Royal Navy and the Merchant Service bound together in one common scheme for the protection of our commerce and the defence of the Queen's Dominions.

ENGLISH AND FOREIGN NAVAL CONSTRUCTION DURING 1888.

THE year 1888 has been one of unusual activity, writes a "Times" correspondent, not only in the Royal and private dockyards of Great Britain, but also abroad, and especially in Italy, Spain, France, and the United States. A new era of naval rivalry seems to have recently begun. States, which not long ago were content to rank as third or fourth rate maritime powers, now betray a tendency to push forward into the second, if not the very first, line; and the threatened disturbance of the old order of precedence among naval nations has already induced nearly every important country to adopt a fresh and more extensive shipbuilding policy.

For the British navy only one battle ship, the *Nile*, was launched during the year, and no battleship was laid down. The *Nile*, a turret ship of 11,940 tons displacement, was laid down at Pembroke in April, 1886, and launched on March 27th last. She is being completed at Portsmouth, and will, it is expected, be ready for sea in 1890. Of protected cruisers, five have been launched during the year, the *Melpomene*, *Marathon*, and *Magicienne* composite cruisers, each of 2,950 tons displacement, and the *Medea* and *Medusa*, steel cruisers, each of 2,800 tons displacement. The *Melpomene* was built at Portsmouth, and launched on September 20th; the *Marathon* and *Magicienne* were both built by the Fairfield Company, at Govan, and were launched on August 23rd and May 19th respectively. They will carry armaments chiefly consisting of 36-pounder and 9-pounder quick-firing guns, and will steam at an extreme speed of about 19½ knots. The *Medea* and *Medusa* were laid down in April, 1887, at Chatham, and were launched, the first on June 9th and the second on August 11th last. Their armaments will be similar to those of the *Melpomene* class; but the vessels will probably steam about a quarter of a knot faster. Two composite sloops, each of 1,140 tons displacement, have also been launched, the *Nymph* at Portsmouth, on May 5th, and the *Daphne* at Sheerness, on May 29th. The armament of each is eight 5in. breechloading and an equal number of machine guns. Engines for both, to drive the vessels at 15 knots on the measured mile, have been furnished by Scott and Co., of Greenock. A smaller sloop, the *Melita*, of 970 tons displacement, was launched at Malta on March 20th. Her speed is 12½ knots, and her armament is similar to that of the *Nymphe* or *Daphne*. Of first-class gunboats, six of one type, and one of another have been launched. Of those of the first type the *Pheasant* was launched at Devonport on April 10th, the *Partridge* at Devonport on May 10th, the *Peacock* at Devonport on June 22th, the *Pigmy* at Sheerness on July 27th, the *Pigeon* at Devonport on September 19th, and the *Plover* at Pembroke on October 18th. They are all cruising gunvessels of the improved Rattler Type, and of 755 tons displacement, with an extreme speed of 13¼ knots. They have wood-sheathed and coppered bottoms, and armaments of six 4in. breechloading and four Nordenfelt machine guns. The remaining first-class gunboat is the *Sharpshooter*, which was launched at Devonport on November 30th. She is of 735 tons displacement, and will have an extreme speed of 21 knots. Her armament will consist of two 36-pounders and four three-pounder quickfiring guns. The other vessels that have been launched are the *Research*, a paddle-wheel surveying vessel of 520 tons displacement, that was launched at Chatham on December 4th, and the *Ernest*, a steel-plated river gunboat for use on the Nile. She was launched at Sheerness on March 27th, after having been housed in for about two years.

Of British warships which have not yet been launched, but which are building or have been ordered, the most important are the two large protected cruisers, *Blake* and *Blenheim*. Both have been designed by Mr. W. H. White. They are twin-screw steel vessels of 9,000 tons displacement and 20,000 indicated horse power, intended to steam 22 knots on the measured mile, and to carry enough coal for a trip of 15,000 nautical miles at the economical speed of 10 knots. The *Blake* is being built at Chatham, the *Blenheim* by contract at the Thames Ironworks and Shipbuilding Company's yard. The length of each is 375 ft., and the beam 65 ft.; and the armament will probably consist of two 22-ton breechloading and 10 70-pounder quick-firing guns, together with 18 3-pounder quick-firing guns, four torpedo tubes, and machine guns. The *Barham* and *Bellona* are two smaller protected cruisers, each of 1,830 tons displacement and a speed of 19·5 knots. They are being built of steel, the former at Portsmouth, where she was laid down on October 22nd, and the latter in the Tyne, by Hawthorne, Leslie & Co. They will each carry six 36-pounder quick-firing guns, and four 3-pounder quick-firing guns, together with two torpedo tubes and machine guns. At a speed of 10 knots they they will be able to steam 2,600 miles. Still smaller are the protected cruisers, *Blanche*, *Blonde*, *Barracouta*, and *Barrosa*, each of which is of 1,580 tons displacement. The armament is similar to that of the vessels of the *Barham* type; but the speed will be 16·5 knots, and the radius of action, at 10 knots, 3,400 nautical miles. The *Blanche* and *Blonde* are building at Pembroke, and the *Barracouta* and *Barrosa* at Sheerness and Portsmouth respectively. Two even smaller partially protected cruisers, the twin-screw sloops *Basilisk* and *Beagle* are under construction, the former at Sheerness and the latter at Portsmouth. They are of 1,170 tons displacement, and will steam at an extreme speed of 14½ knots. To enable them to serve on distant stations, they will be sheathed and coppered. A large torpedo depôt ship, the *Vulcan*, was laid down at Portsmouth on June 18th. She is to be of 6,620 tons displacement, and to steam 20 knots. She will carry eight 36-pounder and 12 3-pounder quick-firing guns, and a number of second-class torpedo boats, and she will have coal to enable her to travel 12,000 miles at 10 knots. The engines are being constructed by Humphrys, Tennant & Co. The smaller vessels which are being built are exceptionally numerous. They include nine first-class gunboats, each of 805 tons displacement, and eight first-class gunboats of the *Sharpshooter* type, each of 735 tons displacement. To the smaller of the two types belong the *Spanker*, building at Devonport, the *Speedwell*, at Devonport, the *Salamander*, at Chatham, the *Seagull*, at Chatham, the *Gossamer*, at Sheerness, the *Sheldrake*, at Chatham, the *Gleaner*, at Sheerness, and the *Scipjack*, at Chatham. To the larger of the types belong the *Magpie*, *Redbreast*, *Redpole*, and the *Widgeon*, which are building at Pembroke; the *Goldfinch*, which is building at Sheerness; the *Lapwing* and *Ringdove*, which are building at Devonport; and the *Sparrow* and *Thrush*, which are building by the Greenock Foundry Company. These vessels may be regarded as improved "Pheasants." Summing up the constructive work of 1888, we find that we have launched, excluding the *Ernest*, which does not figure in the Navy List, 17 vessels, with an aggregate displacement of 35,425 tons, and have set about building 28 vessels, with an aggregate displacement of 41,065 tons. In addition, we have ordered or laid down, for the Special Service Australasian Squadron, five protected cruisers, each of about 2,500 tons displacement and 19 knots speed, and armed with eight 36-pounder and eight 3-pounder quick-firing guns. These vessels will be named *Pandora*, *Pelorus*, *Persian*, *Phœnix* and *Psyche*. For the same purpose we have also ordered two cruising gunboats of the *Sharpshooter* class, which will be named *Whiting* and *Wizard*. These vessels raise the total of our new work for the year to 35 ships, with an aggregate displacement of 55,035 tons.

France next claims attention. During the year she has launched one armoured battleship, the *Hoche*, of 10,480 tons displacement, at L'Orient, and one armoured coast-defence turret vessel, the *Phlégéton* of 1,610 tons displacement, at Cherbourg. The *Hoche*, which was laid down as long ago as 1880, will be armed with two 52-ton guns, and will steam at 15 knots. She is completely belted, the strongest armour on her waterline being 18in., and on her barbettes 16in. thick. The *Phlégéton* will carry a 28-ton gun. Among the unarmoured vessels that have been launched the chief is the *Cécille*, a deck-protected iron and steel twin-screw cruiser of 5,766 tons displacement, which was launched at La Seyne on May 3rd. She will steam at an extreme speed of 19 knots, and she carries six 5-ton, ten 5½in., and ten machine guns. Of the other cruisers, the *Troude* of 1,877 tons displacement, was launched at Bordeaux on October 22nd. She is a steel, twin-screw, 19½-knot vessel, carrying two 5½in. breech-loading and seven machine guns, together with five torpedo tubes. Exactly similar to her is the *Laland*, and slightly smaller (1,848 tons), though of similar armament and speed are the *Coëtlogan*, *Cosmao*, and *Forbin*, all of which were launched during the year. The only other important launch was that of the iron "aviso-transport" *Rance*, at L'Orient. She is a single-screw ship of 1,597 tons displacement, with a speed of 11 knots, and an armament of four 5½in. and two 3½in. breech-loading, and four machine guns. Of the vessels that were laid down previous to 1886 and are still on the stocks, the most noteworthy are the ironclad *Brennus*, and the armoured gunboat *Cocyte*. Among vessels laid down or ordered during the year are an ironclad battleship of 10,480 tons, to be built at L'Orient, two armoured cruisers, each of 6,297 tons, one of which, the *Dupuy du Lôme* is building at Brest, and the other, as yet unnamed, at Roche-

fort. These vessels will steam at a speed of 20 knots, and will each carry two 7½in., six 6½in., and 14 machine guns. They will be completely belted. Three unprotected first-class cruisers have also been begun, the *Isly* at Brest, the *Jean-Bart* at Rochefort, and the *Alger* at Cherbourg. Each is of 4,162 tons displacements, will steam at a speed of 19 knots, and will carry four 6½in., six. 5½in., and ten machine guns. The second-class cruiser *Davoust*, of 3,027 tons, and the third-class cruiser *Surcouf*, of 1,848 tons, together with the torpedo cruisers, *Vautaur* and *Wattignies*, each of 1,273 tons, and two "avisos-torpilleurs," each of 321, together with three torpedo scouts, each of 150 tons displacement, conclude the list, which thus comprises nine vessels, of 28,751 tons displacement, launched, and 15 vessels, of 44,073 tons displacement, laid down.

Russia has launched no ironclads, either in the Baltic or in the Black Sea, neither has she launched any protected cruisers. Indeed, her most important launch was that of the steel 20-knot corvette *Uraletz*, at Nicolaieff. This is a vessel of 1,224 tons displacement. Russia has also launched a steel twin-screw 14-knot gun vessel 950 tons. But what Russia lacks in launches she more than makes up in new constructions. She has laid down in the Black Sea two ironclads, each of 8,000 tons displacement, and in the Baltic one ironclad of 9,800 and another of 6,600 tons displacement. She has also laid down in the Baltic a steel protected 18-knot cruiser of 4,300 tons—these, in addition to the ironclads *Imperator Alexander* and *Alexander Newski*, which were begun previous to 1888. She has, moreover, laid down on the Neva a new steel 17-knot Imperial yacht, of 3,346 tons displacement, to be called the *Standard*, and, in the Baltic, four new corvettes of the *Uraletz* type, each of 1,224 tons displacement. Her year's work may be set down as two vessels, of 2,174 tons displacement, launched, and ten vessels, of 44,942 tons displacement, commenced.

Germany has launched two 14-knot cruisers, *Jade* and *Sperber*, each of 1,300 tons, and four torpedo gun-vessels, each of 250 tons displacement. She has laid down an 18-knot cruising corvette of 4,230 tons, an armoured gun-vessel of 1,200 tons, an ironclad of about 3,200 tons, a 14-knot cruiser of 1,300 tons, and, it is said, more than one of the ships which are comprised in her new naval programme. But, without counting these, her year's work amounts to six vessels, of 3,600 tons displacement, launched, and four vessels, of 9,930 tons displacement, begun.

Italy, during the year, has launched the ironclad barbette ship *Re Umberto*, of 13,298 tons; the torpedo gun-vessel *Confienza* of 745 tons; the torpedo gun-vessel, *Mouzambano*, of 745 tons; the "aviso-torpilleur" *Saetta*, of 317 tons; the steel despatch vessel *Archimede*, of 784 tons displacement; and the cruiser *Piemonte*, of 2,500 tons, together with four gunboats, each of 103 tons displacement. The ironclads *Sardegna* and *Sicilia*, which were laid down some years ago, remain on the stocks at Spezia and Venice respectively. There have been laid down during 1888 four torpedo rams, each of 3,530 tons; five torpedo rams, each of 2,050 tons; one torpedo despatch vessel, of 317 tons; six torpedo gun-vessels, each of 741 tons; and two steel despatch vessels, each of 784 tons. The year's total is 10 vessels, of 18,817 tons displacement, launched; 18 vessels, of 30,701 tons displacement, laid down or ordered.

Austria has launched nothing of any importance, but she has laid down a ram cruiser of 4,200, and another of 3,800 tons displacement, and a despatch boat of 360 tons.

Spain has launched an iron 14-knot cruiser, of 1,152 tons displacement, and a number of small craft of less than 100 tons. In addition, she has begun or ordered six belted cruisers, each of 7,000 tons; two protected cruisers, each of 4,800 tons; a steel cruiser, the *Ensenada*, of 1,046 tons; and four torpedo gun-vessels, each of 600 tons displacement. The protected cruisers are the *Alphonso XIII.*, building at Ferrol, and the *Lepanto*, building at Cartagena.

Norway has been inactive. Sweden has laid down, and is building at Gothenburg, an armoured turret ship, the *Göta*, which will displace 2,915 tons and steam at 16 knots. Denmark has launched at Copenhagen the *Valkyrien*, a fine 17½-knot protected cruiser of 2,900 tons, which will carry two 10-ton breechloaders, six 6in. breechloaders, and 14 machine guns. She has also laid down at Copenhagen a twin-screw double-turretted steel coast defence ironclad of 3,290 tons, which will be capable of steaming 15½ knots, and will carry as her chief armament two 28-ton breechloaders. Both these vessels are of very powerful type.

Holland has launched nothing larger than a torpedo boat, but she has laid down a 15-knot coast defence ironclad of about 2,500 tons displacement, which will carry two 11in. 28-ton Krupp guns as her principal armament. Portugal has launched two small gunboats, each of 220 tons displacement, and has ordered four others. She has also launched a gun-vessel, the *Diego Cam*, of 587 tons. Greece is having two small ironclads built for her abroad, but has launched nothing. Turkey has launched one or two torpedo boats, and has laid down one ironclad of 8,600 tons, two composite cruisers of 1,960 and 1,160 tons displacement respectively, a torpedo despatch vessel of 900 tons, to steam 19 knots, and three torpedo gun-boats of respectively 450, 230, and 120 tons displacement. Want of money threatens, however, to indefinitely postpone the launch of most of these vessels.

Of the Asiatic naval powers, China has this year been upon the whole the more active. There have been launched for her in Europe an armoured turret ship of 2,850 tons displacement, and a steel 15-knot cruiser of 1,300 tons. At home she has launched a torpedo gun-vessel of 450 tons, and a steel cruiser of 2,500 tons. In the meantime she has laid down, or caused to be laid down, four torpedo cruisers, each of 1,500 tons; four gun-vessels, each of 120 tons; and two gun-vessels, each of 150 tons. By, or on behalf of, Japan, there have been launched a small armoured gun-vessel, the *Tisima*, two cruisers of 1,480 and 750 tons displacement respectively, and several torpedo vessels. There have been laid down two deck-protected cruisers, each of 4,140 tons, in Europe, and another of the same type at Yokosuka, and some sea-going torpedo boats.

The United States Navy Department has of late been busily engaged in the carrying out of a somewhat extensive ship-building programme, which should be completed during the next three years. This year five important vessels have been launched. The largest of these is the steel twin-screw deck-protected cruiser *Baltimore*, which was built by Crump & Sons, of Philadelphia, between May 5, 1887, and October 6, 1888, a period of only 17 months. She is of 4,400 tons displacement, and is expected to steam at 20 knots under forced draught, and at 17 knots under natural draught. She has room for 900 tons of coal, a quantity sufficient to last her for a cruise of 12,000 sea miles at 10 knots. The armament will be four 8 in. breech-loading guns in sponsons, six 6 in. breechloading guns in broadside, six 6-pounder quick-firing guns, and six Hotchkiss and four Gatling machine guns. A second, but rather smaller steel-protected cruiser, the *Charleston* was laid down at the Union Ironworks, San Francisco, and launched on July 19 last, after having been on the stocks only 11 months. She is of 3,730 tons displacement, and is expected to steam 19 knots under forced draught. Her coal capacity is 800 tons, or sufficient for 6,450 knots steaming at 10 knots. Her armament will be two 8in. breechloading guns mounted on the fore and aft midship line, six 6in. guns in broadside, four 6-pounder quick-firing guns, and six Hotchkiss and four Gatling machine guns. The gun vessel *Petrel*, which was recently launched from the works of the Columbian Company, at Baltimore, is a small steel bark-rigged cruiser of 870 tons displacement. She will steam at a speed of 13 knots, and will carry four 6in. breechloading guns in sponsons, two 6-pounder quick-firing guns, and two Hotchkiss machine guns. Another and larger gun vessel, the *Yorktown*, was launched by Crump & Sons, of Philadelphia, on April 28. She is really a partially protected steel twin-screw torpedo cruiser of 1,700 tons displacement, and she is expected to steam at 17 knots. Her armament is six 6in. breechloading guns, five quick-firing guns, and two Hotchkiss and one Gatling machine gun, together with eight torpedo tubes. In addition, the Americans launched on April 28 the *Vesuvius*, which is more generally known as the dynamite-gun cruiser. She is a steel twin-screw vessel of 805 tons displacement, and her extreme speed is 20 knots. She carries three 15in. pneumatic tubes, placed abreast at a fixed angle of 16 degrees, and projecting through her deck near the bow. Each of the shells for these guns contains 600lb. of explosive gelatine. During the year there have been laid down two ironclad battleships. One, the *Texas*, has been designed by Mr. W. John, late manager of the Barrow Shipbuilding Company, and is being constructed at the Government Navy yard at Norfolk. With 950 tons of coal on board she will displace 6,750 tons; and she will steam 17 knots under forced draught. She will be armed with two 12in breechloading guns, placed in turrets, *en échelon*, and with six 6in. breechloading guns, four 6-pounder, and four 3-pounder quick-firing guns, and eight Hotchkiss and two Gatling machine guns. The *Texas* will have a central armoured citadel, and a

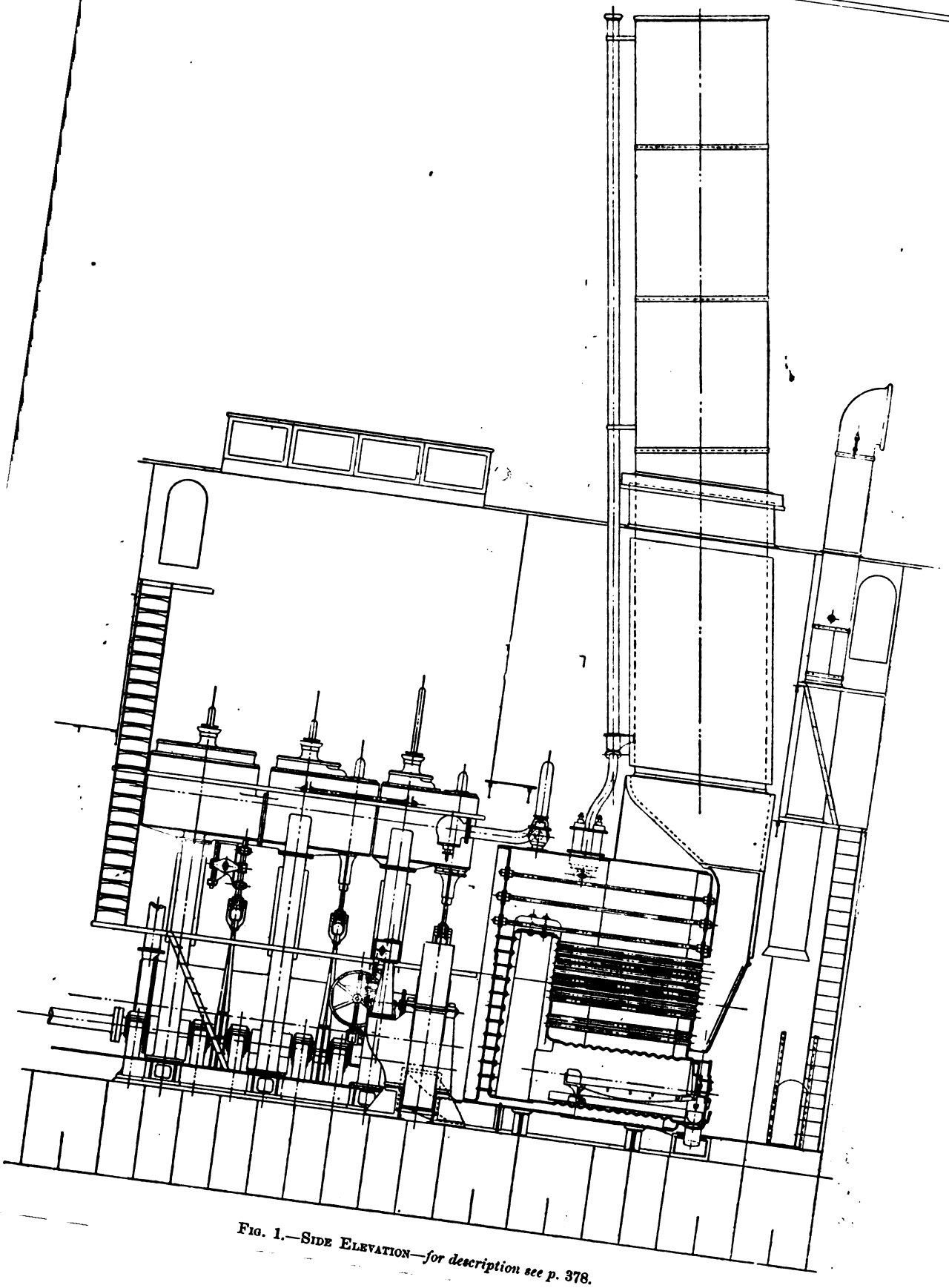


FIG. 1.—SIDE ELEVATION—*for description see p. 378.*

3in. steel deck ahead and astern of it. The cost, exclusive of that of the armament, is to be £475,200. The other ironclad battleship, the *Maine*, is being built by Government at New York. She is to be of 6,648 tons displacement, to be bark-rigged, and to steam at an extreme speed of 17 knots. She will carry four 10in. breechloading guns mounted in pairs in two turrets, while will rise, *en échelon*, on the main deck. She will also carry six 6in breechloading guns, four 6-pounder and four 3-pounder quick-firing guns, and 13 Hotchkiss and four Gatling machine guns. Five other vessels have also been laid down during the year—viz., the *Newark*, protected 17-knot steel cruiser of 4080 tons, at Philadelphia; the *Philadelphia*, protected 19-knot steel cruiser of 4,410 tons, at Philadelphia; the *San Francisco*, protected 17-knot steel cruiser of 4080 tons, at San Francisco; and the *Concord* and *Bennington*, steel cruising 16-knot gun vessels, each of 1,700 tons, at Chester, Pennsylvania. All these vessels are of good design, and powerfully armed, and substantial premiums have been offered to the builders for every knot of speed above the contract rate.

The other American States have shown very little constructive activity. Chili has a 4,500 ton 19-knot cruiser building for her in England, but the vessel was laid down previous to 1888; the Argentine Confederation has begun a 14-knot ironclad of 4,330 tons. Brazil has on the stocks a 17-knot cruiser of 4,023 tons, and is also building some torpedo vessels, and Uruguay has launched an iron gunboat of 300 tons displacement. But Mexico and Hayti have done nothing; and Peru has, as yet, taken no step towards replacing the navy which it lost during the war with Chili.

THE INTRODUCTION AND DEVELOPMENT OF STEEL SHIPBUILDING.—I.

MUCH has been written and said on this subject since the initiation of building in mild steel in this country, about thirteen years ago, and particularly since the first marked impulse was given to the system during the years 1877-9. From time to time papers have been read before the several societies connected with the science and practice of shipbuilding, engineering, and metal manufacture, tracing the progress already made, and discussing the prospects for the future. To a large extent these papers, and the discussions they provoked, are characterized by theorizings and contentions, which are disproved by subsequent experience in actual practice, and the papers are thereby rendered tedious and burdensome as records of what has actually been achieved. It appears, therefore, worth while to trace, in a connected form, succinctly, and in historical order, the whole line of progress and the causes to which this progress is due. That the time has now fully come when this may safely be entered upon will be conceded, when it is remembered that last year, of the total tonnage built for the world's mercantile marine—wood, iron and steel combined—no less than 72·2 per cent. consisted of steel vessels. Viewing the subject of the development of steel building, according to countries and districts, the supremacy of steel construction is now, in many quarters, complete and permanent. This is particularly so in those centres favourably situated for the manufacture of the approved material; and on the Clyde the fact of a vessel being constructed of iron at the present time is more a matter for wonderment than the construction of one in steel was, only ten years ago.

Although the introduction of steel as a material for shipbuilding dates, at least, as far back as 1860, its use had been but partial, or occasional, until about the year 1875. The uncertainty as to quality, the frequent great disparity between pieces cut from the same plate, and the special care needed in the manipulation prevented its general adoption. With the highly improved "mild steel," however, first manufactured in France, and applied to ship-building purposes there about the year 1874, and subsequently introduced into this country, began the more extended adoption of steel, which every day, or with every accession to experience, has continued to displace iron.

The facts relating to the introduction into this country of mild steel for ship-building purposes, may be briefly recounted. In the latter end of 1874, Admiral Sir W. Houston Stewart, Controller of the British Navy, and Mr., now Sir A. Barnaby, Director of Naval Construction, availed themselves of the opportunity to observe and study the use of steel in the French dockyards of L'Orient and Brest, where three first-class armour-plated vessels were then being built of steel throughout, supplied from the works at Creusot and Terrenoire. Mr. Barnaby, at the meetings of the Institution of Naval Architects, in March following, gave an account of his observations during this visit, and pointed out clearly and precisely to the steel makers of Great Britain, all the indispensable conditions which would have to be met and satisfied by steel for shipbuilding, so that it could be used with confidence in the construction of the largest vessels. Before the end of 1875, the Company owning the Siemen's Steel Works at Landore was enabled to produce material by the Siemen's-Martin process, fulfilling all the conditions stipulated for by Mr. Barnaby. The Admiralty thereupon contracted with this Company to supply the plates and angles necessary for the construction of two cruisers of high speed, the *Iris* and the *Mercury*, then about to be built. Mr. James Riley, manager of the works in question at that time, replied to Mr. Barnaby in a paper read before the Institution of Naval Architects in March, 1876, in which, after enumerating the advantages claimed for Siemen's-Martin steel over iron, he stated that these considerations forced upon him the conclusion that only a short time must elapse before the value of the material, being more and more recognised, it would replace iron in the construction of vessels. Shortly after the Landore Company, the Bolton Steel Company was, in its turn, able to produce, by the Bessemer process, plates and angles satisfying all the requisite conditions. The Steel Company of Scotland, by whom the services of Mr. Riley were early secured, the Butterby Company, and other important works, also entered into the same business, and operations were simultaneously set a-going in various parts of the country connected with the formation of new works and the perfecting of other processes.

During the month of March, 1877, plans were received at Lloyds' Register from Messrs. John Elder & Co., for the construction of two paddle steamers of the following dimensions: 221·3 by 27·7 by 10·6, which were proposed to be built of Siemen's-Martin steel, and to be employed in the English Channel passenger service. In these vessels the scantlings were approved by Lloyds' Register Committee, at a reduction of some 20 per cent. from what had been adopted for iron vessels for similar service. These vessels, it is understood, have answered well in every way, and have fully borne out in their behaviour the anticipations expressed as to the suitability and superiority of mild steel over iron in the construction of merchant vessels.

In the same year the principal officials of Lloyd's Register visited the principal steel works in the country for the purpose of reporting on the question of the conditions under which mild steel might be sanctioned in the general construction of merchant vessels to be classed in Lloyd's register book for general purposes of trade, and a copy of the report they made is appended to the Transactions of the Institution of Naval Architects for 1877. In that report it was recommended that steel should be admitted in the building of ships for classification of scantlings generally 20 per cent. lighter than prescribed for iron, subject to the material fulfilling certain defined tests, viz., a tensile strength of 26 to 30 tons to the square inch, and an elongation of 20 per cent. on a length of eight inches. These proposals were approved by Lloyd's Register Committee, and rules to this effect were issued to the public. Subsequently the tensile limits were slightly increased to 27, to 31, and then 28 to 32 tons to the square inch, as being in accordance with further experience gained of the material in its use in the mercantile marine.

Proposals for building steel sailing and steam vessels rapidly followed the issue of these rules, and resulted in the construction of seven steamers, of an aggregate tonnage of 4,490 tons, which were classed in Lloyd's Register in the year 1878; whilst, in addition, a number of steel vessels were in course of construction, but not completed in that year.

Subject, as it was, to systematic and severe tests, continually applied, the steel thus supplied was found to be possessed of the qualities of ductility, malleability, and homogeneity, which rendered its employment in shipbuilding not only permissible, but highly desirable. The experience of all having practical dealings with the material in the shipyard showed that it entirely satisfied, even more than iron, all the requirements of easy manipulation. The confidence with which it could be relied on, as to its certain and uniform qualities, placed it on a much higher level than the steel formerly manufactured; and

its superiority over the best wrought-iron as regards strength and ductility, rendered it a highly preferable material.

Mild steel, therefore, from the point of view of the shipbuilder, was clearly advantageous, but there were other considerations which rendered the desirability of its adoption still very doubtful from the standpoint of the shipowner. It was not to be expected that shipowners generally would turn their back upon iron, and accept mild steel, simply through a sentimental appreciation of the superiority of the new kind of metal, apart from such questions as whether a steel vessel would be more costly to build or more expensive to maintain in active service than an iron vessel, and whether the wearing powers and lifetime of the steel ship would be less than her iron rival. On the contrary, these questions weighed largely with shipowners, and the doubtful, and to some extent discouraging answers given to them were decided impediments to any very rapid advance in steel shipbuilding for a time. The enormous interests vested in the ownership of iron vessels, and in the manufacture of ship iron were elements in the silent conflict, and, naturally enough, their influence tended to the discrediting of the new material. The few imperfections and failures met with in the early employment of mild steel, the fears entertained by many regarding the rapid corrosion of the material, its want of structural rigidity, and above all, the greater first-cost of building steel ships were considerations seized upon and made much of by the partizans of iron.

Constant improvements in the manufacture, however, and unremitting attention in the testing of steel by Lloyd's Society, and others responsible, soon established complete faith in its reliability. With the exception of fears as to the rapid corrosion and the want of rigidity of steel ships, the question of first-cost was soon the only positive obstacle in the way of the universal adoption of steel shipbuilding. But even this was at once courageously met, and gradually removed by manufacturers and users of the new material. It was abundantly proven that, even with the price of steel half as high again as iron, the economical advantages of building in the more costly material were clear and considerable. This was first publicly dealt with by Mr. Martell, in a paper on "Steel Shipbuilding," read before the Institution of Naval Architects in 1878, in which he showed that a cargo steamer of 316 feet long, by 36 feet broad, by 25 feet 6 in. deep, with a gross register of 2,300 tons, and 200 horse power, could at that time be built in steel, and ultimately prove a more profitable ship than if built of iron. The same thing was shewn to be still more certain in the case of a sailing ship of 1,700 tons gross register. This subject was next taken up by the late William Denny, in a paper upon the "Economical Advantages of Steel Shipbuilding," read before the Iron and Steel Institute in 1881, who showed that, although a spar-decked steamer of 4,000 tons, built of steel, at that date entailed an excess in cost of £3,750 as compared with a similar vessel built of iron, the immediate and ultimate advantages pertaining to the steel ship, made it clearly desirable to build in that material. The facts and reasoning by which those who advocated building in steel upheld their position need not be entered into detail, because their arguments have prevailed, and been fully substantiated in actual experience since, but the following generalizations are necessary.

It has already been stated, that the reductions in steel, as compared with iron, permitted by Lloyds, was equivalent to 20 per cent. in scantling. For reasons, however, which will hereafter be made clear, the saving effected in actual practice only amounted on the average to about 12 or 13 per cent. on the total weight of material used in steam ships, and about 15 to 17 per cent. in sailing ships. This represented, in the finished vessels, that is, the vessels with all wood and smith-work fittings complete, a saving in weight of about 8 to 10, and 14 to 16 per cent. respectively. This gain might either take the form of a corresponding increase in the dead-weight carrying power of a proposed vessel, or the dimensions and form could be lessened or modified to meet the nett carrying power required. It was thus found that in trades where there is a constancy of dead-weight cargoes this increase in dead-weight carrying capability speedily recompensed owners for extra first cost. In trades, however, where the cargoes consisted of measurement goods, the advantage was not so evident, as it often happened that before vessels were loaded to their maximum draught, the limits of stowage were reached. Even in this event, however, a steel vessel had a clear advantage over her iron rival. Her hull was from 8 to 10 per cent. lighter, and consequently could be propelled at a given speed with much less expenditure of power, and not only so, but she had the additional recommendation—often a very important one—of a shallower draught of water. This latter consideration alone, in services where every fraction of such saving is important, induces many shipowners to build in steel.

Through the progress in, and extension of, mild steel manufacture, and the consequent improvement in quality and reduction in price, the conditions for steel shipbuilding were rendered more and more favourable, as time went on. In 1877 the sources of supply had been so few, and the rigorous testing to which the material was subject entailed such expense, mild steel was about double the cost of the iron in common use. In 1880, owing to the increased source of supply and the improvement in manufacturing plant and appliances, the cost of steel had been reduced to a figure of only about 50 per cent. higher than iron. In 1884, owing to continued improvements, and the adoption of less expensive modes of testing, which had taken place in the interim, the price of steel was reduced to a figure only some 25 per cent. higher than that for iron. At the meetings of the Iron and Steel Institute of the year just mentioned, Mr. William John, in a paper upon "Recent Improvements in Iron and Steel Shipbuilding," showed that at that time the point had been reached where the relation between steel and iron was such as to make the steel ship as cheap in first cost, per ton of dead-weight carried, as her iron rival. At the meetings of the same Institute, in the year following, it was demonstrated by Mr. J. H. Biles, in his "Notes on Steel Shipbuilding," that the relative cost of steel to iron on the Clyde was then such as to enable Clyde builders to construct steel ships of the same dimensions as iron ones at practically the same price, and that, therefore, the shipowner was in a position to have a considerable increase to his dead-weight carrying and freight earning capacity merely by deciding to build in steel. "I think," declared Mr. Biles, "it may now be fairly claimed for a steel ship, built to Lloyd's scantlings, as compared with an iron one of the same dimensions, that its first cost is not greater, its strength is greater, liability to loss from collision or stranding is less, its liability to damage by corrosion need not be greater, and its dead-weight carrying capability (which is the *raison d'être* of nine ships out of ten) is much greater." He subsequently adds, "there does not, therefore, appear to me to be any reason, with prices as they are at present, why another iron ship should be built upon the Clyde or any other river, where steel can be produced relatively to iron, as cheap as it is here." Of the prices quoted to shipbuilders on the Clyde for steel and iron at that date the mean overhead rates were for steel £6 9s., and for iron £4 19s. 3d.

The results above indicated, however, were not entirely due to the reduced relative price of steel to iron, but in large measure to structural improvements, which the superiority of steel permitted, and the skill of ship-builders effected. Prominent amongst these, of course, was the matter already noticed, of the reduced scantling of steel, allowed by Lloyd's on their requirements for iron. This, as has been already stated, was 20 per cent.; but it must be explained that the units of measurement then employed, being 16th and 32nd parts of an inch, it was impossible to so adjust the scantlings of every item as to take full advantage of this reduction. The thicknesses, actually equivalent to 20 per cent. reduction, fall in many cases at points intermediate between those expressed by sixteenths and thirty-seconds of an inch; and Lloyd's Committee, as a rule, insisted on having the thickness, which lay above, rather than the one coming below the accurate equivalent. Recurring, as this did, in the innumerable items of a vessel's structure, the result in the aggregate was a serious increment to the total weight. To this cause, and to the fact that iron (for cheapness' sake) still continued to be used in steel vessels for unimportant features was due the lessened saving in weight attained in practice—12 to 13 per cent in steamers, and 15 to 17 per cent. in sailing ships—as compared with the saving of 20 per cent. theoretically permissible. With, however, the more equitable and highly convenient scale of scantling adopted by Lloyd's in their rules of 1885, and with the increased employment of steel even for the most unimportant features—due to the reduced relative cost—a nearer approach can now be made to the full reduction in steel ships. The change referred to is that of substituting for sixteenths-of-an-inch in iron the corresponding number of twentieths-of-an-inch in steel. This, it will be at once seen, enables the full reduction to be secured on the thickness or sectional area of every item in the structure. After allowing for the different specific gravities of the two materials, the reduction in the total weight of the steel ship thus secured is

equivalent to about 17 per cent. This reduction exists, however, mainly in theory, and is scarcely ever obtained in actual practice, except in sailing ships and small cargo steamers. The cause of this lies in the fact that, after allowing the 20 per cent. reduction in thickness generally, Lloyds', for purposes of strength, ask for an increase in the thickness of certain butt-straps of the outer bottom plating and the deck stringers as well as for an increase in the number of rivets at the butts. These demands practically keep down the nett gain in weight of material to the figure originally stated: *i.e.*, an average saving of 13 per cent. There are other advantages, however, due, not to reduced scantling, but to improvements in structure, which largely compensate for this.

Owing to the readiness on the part of steel manufacturers generally to supply material of the largest superficial dimensions—which new plant, constructed with a view to supplying modern demands, enabled them to do—it was found that a distinct source of economy was thus opened up to the shipbuilder. The advantageous effects of using larger plates in the hulls and decks of ships was found to consist in the facts that less weight, for a given thickness, was used in laps and butt-straps, less rivetting was required, less scrap was produced, less time was required in construction, and less cost for labour was involved. By means of a table of figures, giving the results of careful calculations on two different types of ships, Mr. Biles showed, in the paper above referred to, that by using steel in place of iron, there is, on the total weight of plates, angles and rivets, a saving, in the case of a 1,500 ton sailing ship, of 13½ per cent., and in the case of a 5,500 ton cargo passenger steamer of 12·07 per cent. This is all on the assumption that the limits of length and breadth of the plates are the same in both kinds of material. But on the assumption that the limits of length and breadth are greater by 2ft. and by 6ins. respectively than the sizes by which above results are obtained, then the percentage of reduction in total weight is 15·83 on the sailing vessel, and 13·44 on the steamer, or an increased reduction due to the increased dimensions of plates alone of 2·5 and 1·37 per cent respectively. The desire to avail themselves of the larger plates supplied by steel makers has become much more pronounced during the past year or so amongst shipbuilders. Many have added to their plant machines of the heaviest calibre, and others have so far modified and re-arranged their works as to be capable of dealing with the larger-sized plates. In the two new White Star steamships being produced by Messrs. Harland & Wolff, the steel plates are of double the usual length, viz., 28 ft. 9 in. The average size of steel plates now being used by Messrs. J. and G. Thomson, Clydebank, is 20 ft. by 5 ft. 6 in.

Amongst other minor improvements in ship-building, due to the use of such a ductile material as steel, which result in diminished weight and cost, the practice of flanging may be instanced. In many steel vessels—mostly of light scantling—the edges of plates have been flanged to form connection with other plates, instead of the connecting angles usually employed for this purpose. In a paddle-boat being built in Messrs. Thomson's yard at the time, Mr. Biles read his paper, the usual reverse bars were not fitted along the floor plates, but the top edge of these plates were flanged so as to correspond to the horizontal flange of the reverse bar. By this means a saving equivalent to one flange of an angle, and all the rivets, which connect the reverse bars to the floor plate, was effected on each floor. Besides this, flanging was then extensively adopted by Messrs. Thomson for bracket work and intercostal work, instead of connecting angles, for bulkheads where the flanging of the plate edges took the place of angle stiffeners, and for various other purposes. This flanging, it may be added, was done cold, when the plates were under ⅜ins. thick, but above this it was done with the plates hot. Messrs. Thomson have continued to develop these ingenious devices for saving weight and workmanship without loss of efficiency.

(To be continued.)

THE JUNIOR ENGINEERING SOCIETY.—The annual dinner of this very successful Society was held on Friday evening, January 18th, at the Holborn Restaurant, Professor W. C. Unwin, F.R.S., the President, being in the chair. Amongst those present were Sir Nathaniel Barnaby, Mr. William Anderson, Professor Armstrong, and Mr. S. H. Wells, the chairman of the Society. The arrangements were made in a way that reflects the greatest credit on the officers of the Society, and a very enjoyable evening was spent.

STEAM BRANCH OF THE ROYAL NAVY.

THE question of the efficiency of the Navy for the duties it would be called upon to perform in time of war, now occupies a prominent position before the public. The manœuvres of last summer are, it is understood, to be repeated this year, and the necessity of strengthening our fleets and shore defences will doubtless then be further demonstrated, for such increase in strength is evidently necessary to enable us to protect our coasts, our ocean trade routes and our Colonies. The country will be glad to know the proposals which the First Lord of the Admiralty has stated he will shortly make for strengthening the fleet. But one point we trust is being borne in mind, viz., that it is of quite as much importance to provide for the satisfactory manning of the ships as to provide for their construction. It is well known that in order to man the ships for the manœuvres last year great efforts had to be made, and the officers and crews of the harbour ships had to be extensively drawn upon; especially was this said to be the case in the steam department; so much so in fact, that an insufficient staff was left at the Dockyard ports for the proper maintenance and preservation of the vessels which were not put into commission owing to being incomplete, or for some other reason.

Now in these days when every modern vessel of war is practically one complicated machine, each successive type requiring more care and skill, for each is designed to do greater things than its predecessor, in accordance with the advancing powers of science and construction, it is highly necessary that the staff having the care and management of all the machinery in these ships should receive as much attention as the ships themselves. And it is to be hoped that the Admiralty will take care that there shall be no failure of the Navy on account of insufficiency of engine-room staff. The necessity of nearly emptying the harbour ships to commission a limited number of vessels last summer shows there are not sufficient even for peace time, and if war actually occurred additional numbers would quickly be required for manning other ships to replace losses in action, &c.

Not only does there appear to be a necessity for increase in the lower ratings of the engine department, but from the evidence adduced before the Select Committee of the House of Commons on the Navy Estimates it is evidently under-officered, a fact that was pressed home to that Committee by Sir E. J. Reed. The number of officers of the Engineer branch in a ship is so small compared with their duties and the number of men under their charge, that it certainly appears doubtful whether those duties could be satisfactorily performed in time of action (for which the war vessel exists) with so limited a number of Engineer officers.

Whilst considering this question the Admiralty cannot overlook certain representations which have recently appeared, showing that the Naval Engineers, whose duties and responsibilities would seem to entitle them to every consideration that fairness might demand, are actually in a position which very naturally is anything but satisfactory to themselves, and cannot be to the public either, who would doubtless wish to see public servants paid in proportion to their value. The statistics furnished by the reports of the Select Committee of the House of Commons on the Navy Estimates show that the average pay of the officers of the Engineer branch is very much below that of any other class of commissioned officers in Her Majesty's Navy. In the senior grades of Fleet Engineers their maximum full pay is as much as £200 per year less than that of accountant or medical officers of equal age, rank, and service, while Engineers get £60 per year less than surgeons as their maximum rates of pay, and an assistant Engineer receives just over one half the pay of a medical officer on joining the Navy, and is considerably behind him in relative rank. Bearing in mind the fact that our war-ships are dependent for their every operation and their very existence on the efficient discharge of the enormous and all-absorbing duties of the Naval Engineer department, it is not too much to ask that the officers of this department should be treated with the same amount of consideration which is shown to other branches who are of no more value to the Navy than the Engineers, and whose duties and responsibilities (without at all wishing to be invidious) cannot be compared with those of the Engineer officers. The anomalies we have herein referred to constitute a very grave defect in the efficiency of our War Navy as relates to the Engineer branch, and it is absolutely necessary that they should be removed. In our last issue we stated the demands

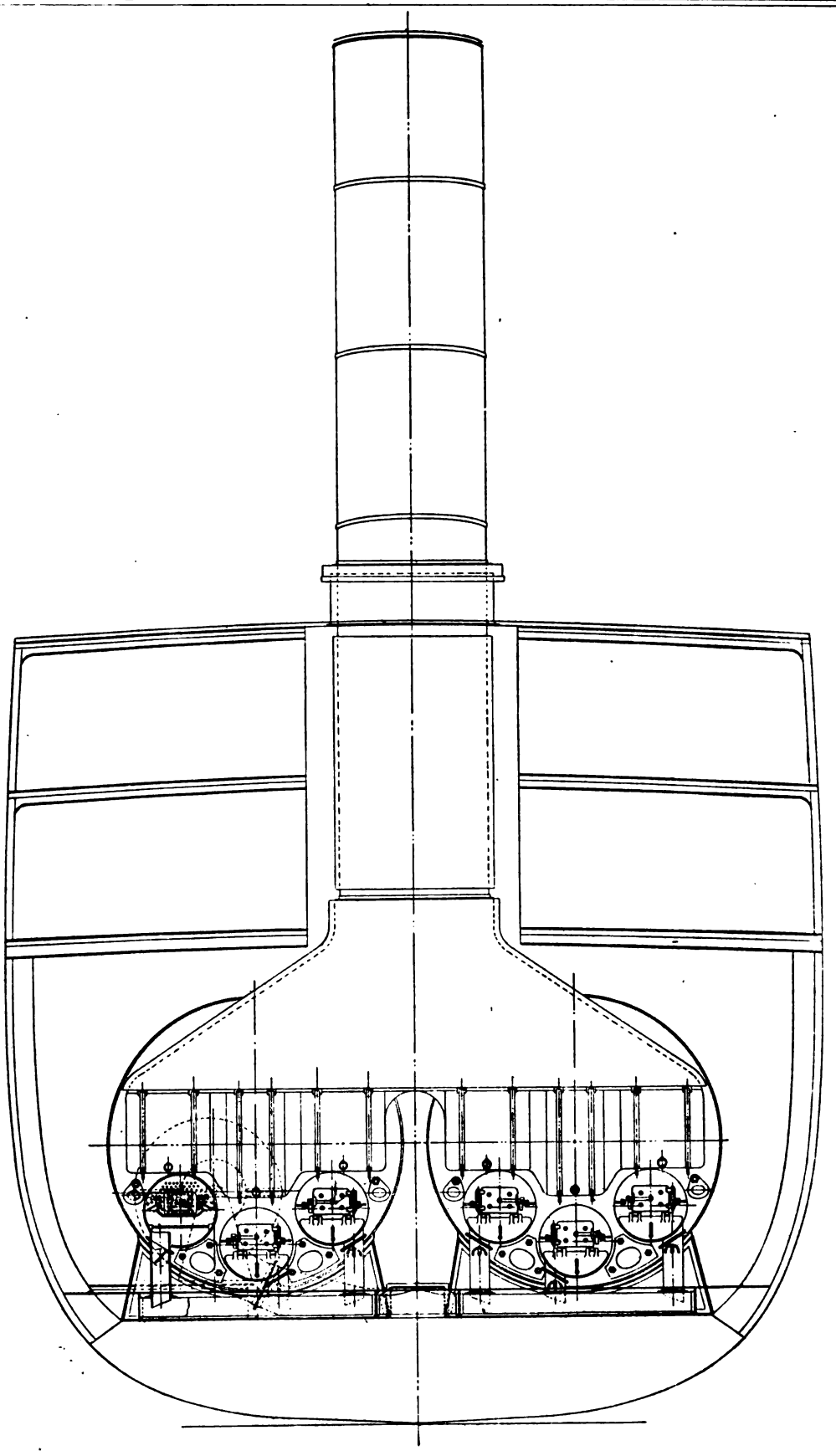


Fig. 3.—End Elevation—*for description see p. 378.*

of the Engineer officers with regard to their position and pay, and remarked that they had neither overstated their grievances nor asked that they should be remedied in an unjust manner. We here state that the Engineer officers are simply asking for the same amount of consideration in matters of rank and pay which the other Civil branches of the Navy have accorded them, and we commend their very moderate and just demands to the Admiralty and to all who take an interest in the matter, and who may be enabled to procure the steam branch of H.M. Navy the recognition which its importance and its value fairly entitle it to.

possess all the firm's well known characteristics of design, solidity of construction, and economy of space being specially noticeable. The latter qualification is better seen on reference to the diagrammatic views Figs. 1, 2, and 3, which show respectively a side elevation of the engines, boilers, and forced draught arrangement, a plan of the same, and an end elevation of the boilers, showing the furnace fronts and the forced draught connections.

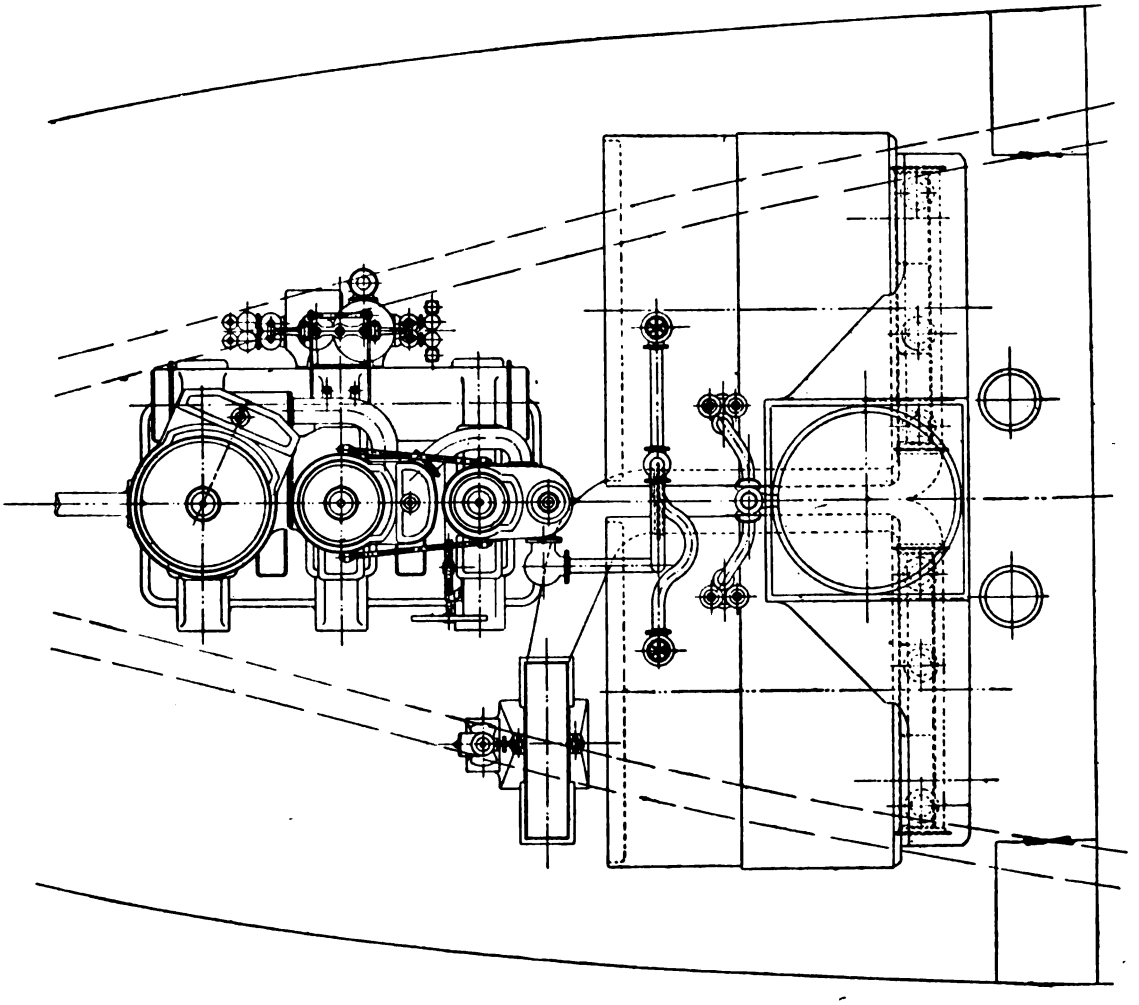


Fig. 2.—General Plan.

COMPOUND TRIPLE-EXPANSION ENGINES.

By the Wallsend Slipway and Engineering Company, Limited.

WE have much pleasure in herewith illustrating a very compact arrangement of triple-expansion machinery as designed and fitted by the Wallsend Slipway and Engineering Company, Limited, of Newcastle-on-Tyne, on the *Elbruz*, *Kasbek*, *Darial*, and *Russian Prince*, four vessels lately built by Messrs. Sir W. G. Armstrong, Mitchell & Co.

As will be seen from our double page supplemental illustrations, representing respectively side and end elevations of the engines, these sets of machinery

Briefly we may state that the four vessels named each carry 4,000 tons at a speed of 10·5 knots, the engines when running at this speed indicating 1,580 horse power.

The cylinders are 23 in., 37 in., and 60 in. diameter, the length of stroke being 39 in. The boilers, two in number, have a mean diameter of 13 ft. 9 in., with a mean length of 10 ft. 9 in., and supply steam at 150 lbs. pressure. The forced draught is on the closed ash-pit system, arrangements being provided at the furnace fronts for regulating the admission of air above and below the fire bars. The necessary air is supplied by a fan 6 ft. diameter placed, as will be seen from Figs. 1 and 2, near the starting platform in the engine-room.

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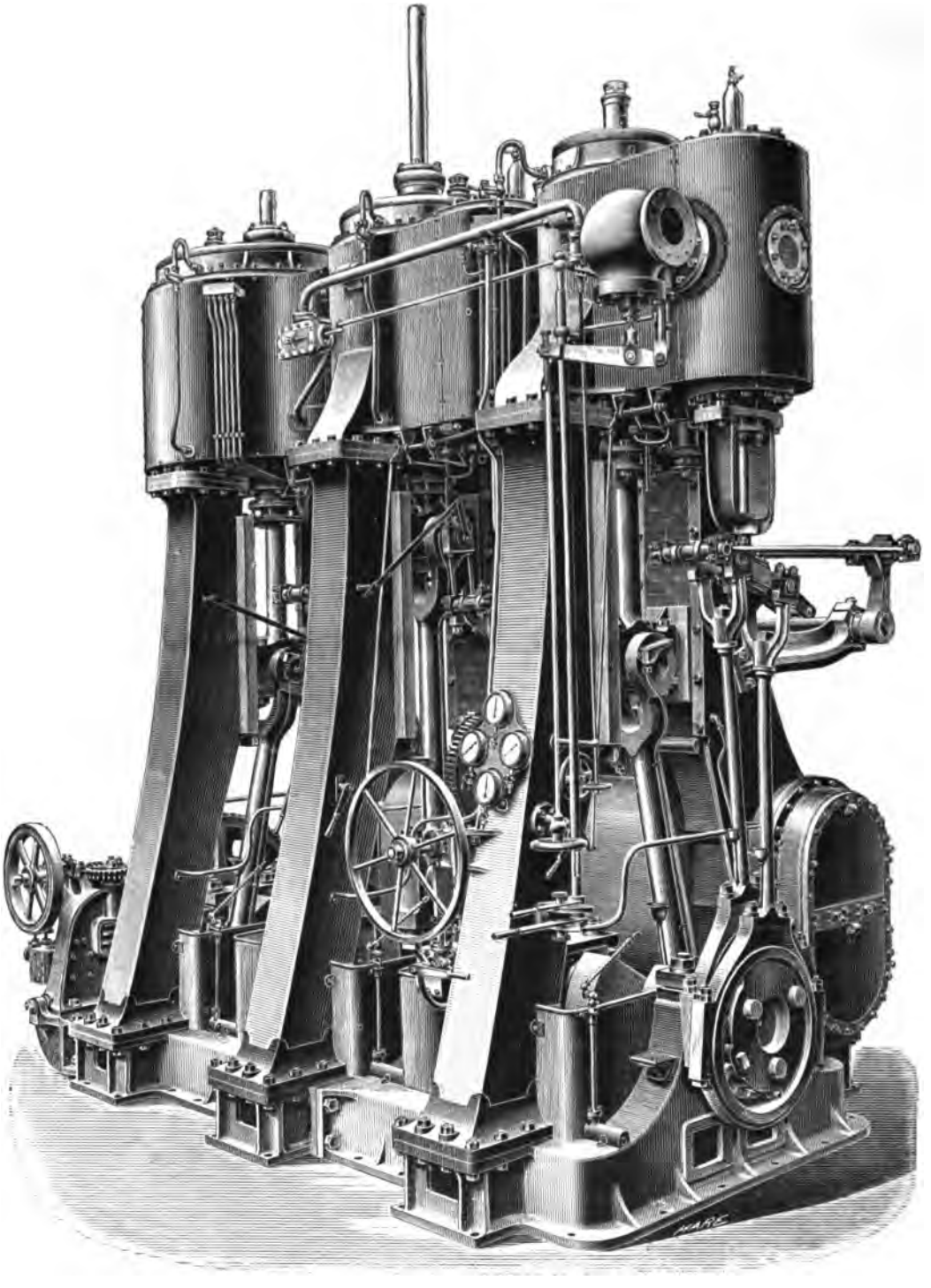
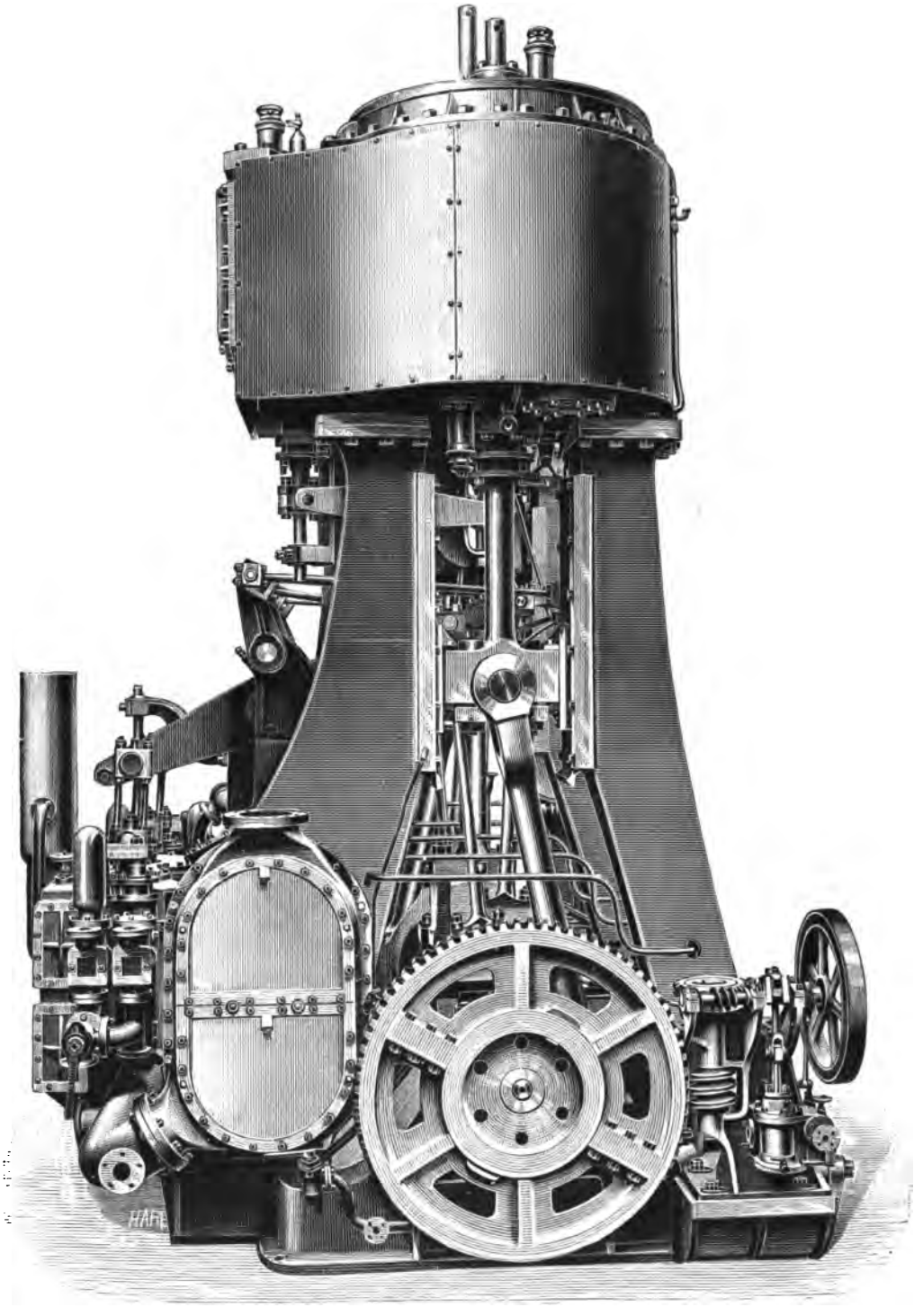
ASTOR, LENOX AND
TILDEN FOUNDATIONS.



COMPOUND TRIPLE-EXPANSION ENGINES, S.S. ELBRUZ.

CONSTRUCTED BY THE WALLSEND SLIPWAY AND



S.S. KASBEK, S.S. DARIAL, AND S.S. RUSSIAN PRINCE.

Engineering Company, Newcastle-on-Tyne.

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ASTOR, LENOX AND
TILDEN FOUNDATIONS.

As will be seen from the supplemental end view, these engines are provided with a steam turning engine, which is a great improvement. From these supplemental views it will also be seen that every part of the engines are readily "get-at-able" either for examination or repairs, and that while paying every regard to economy of space, the engines have not been robbed in any single part of their due proportion of strength, all wearing surfaces being amply large and substantial. It will be observed (*vide* Fig. 2) that fore and aft length is curtailed by putting the low pressure slide obliquely, as shown on the port side; while (*vide* Figs. 1 and 2) stiffness is gained by bracing the high pressure cylinder to the others by tie rods.

A combined hand and steam reversing gear is fitted, and all the starting, stopping, and other levers are conveniently arranged so as to allow of the engines being rapidly and easily handled.

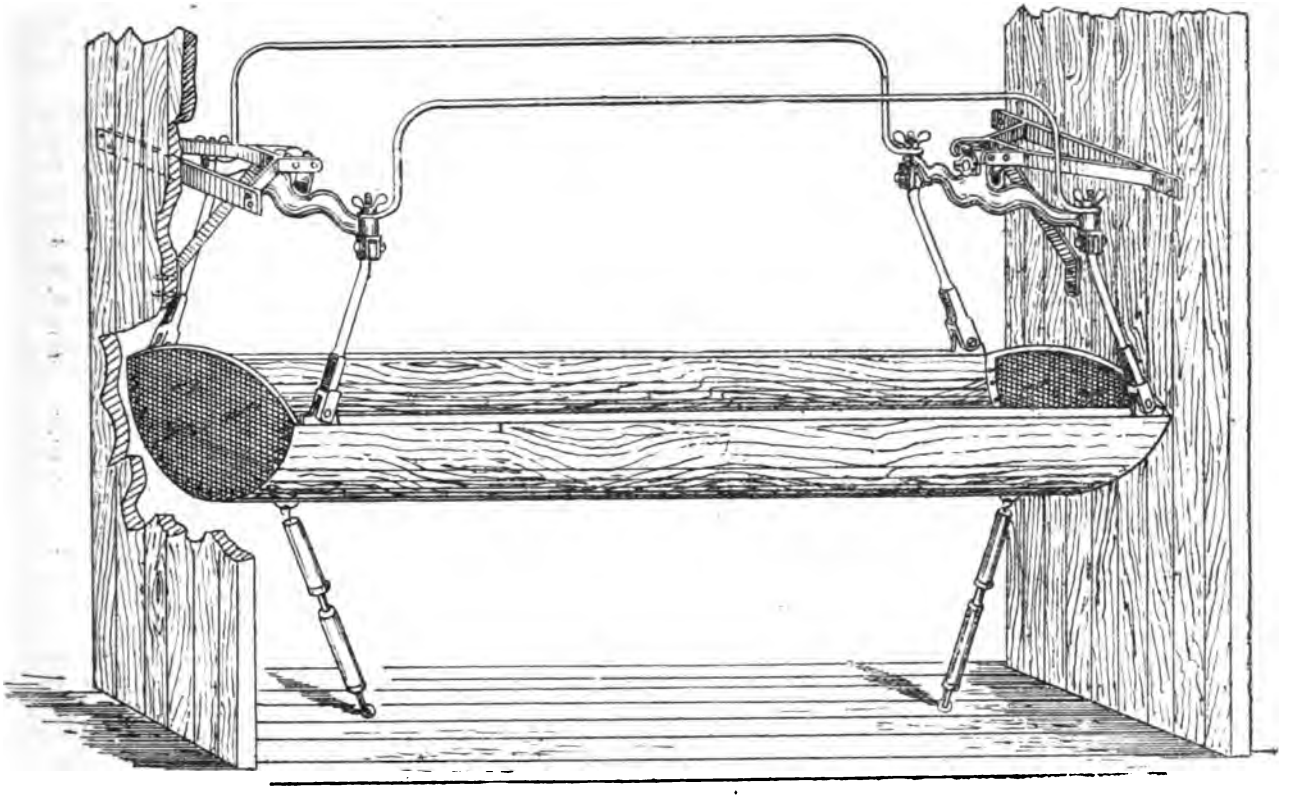
The Company are to be congratulated upon their success with these engines, and will, we trust, receive a long run of orders for machinery of this type.

THE SUEZ CANAL.—The transit revenue collected by the Suez Canal Company last year was £2,593,506, as compared with £2,314,495 in 1887, showing an increase of £279,011 last year. The number of vessels which passed through the canal last year was 3,440, as compared with 3,137 in 1887.

ADJUSTABLE SHIP'S BERTH.

THE accompanying illustration shows a new form of ship's berth, designed by Mr. Goodwin, a full-sized working model of which we recently inspected at the offices of Messrs. F. Prince & Co., 31, Craven Street, Strand, W.C.

Needless to say, the object of the invention is to prevent sea-sickness, and judging from the demonstration of its capabilities made before us, and the very satisfactory manner in which, we are told, it behaved during a rough voyage across the Atlantic, when fitted on the steamship *Sardinian*, this great *desideratum* of passengers seems to be well met. As further showing its capacity for maintaining an "even keel" during rough weather, we were informed that during a voyage of the *Invicta* across the Channel, a board placed across one of these berths carried an ordinary tumbler, filled brimming full of water, without any perceptible loss by spilling.



As will be seen from the illustration, this berth occupies but very little more cabin room than the ordinary construction of berth, the various points of suspension and the lengths of the connecting links being so arranged that the movement of the berth would be practically *nil*, even with a vessel rolling or pitching to her maximum, nor is there any danger of an end or side "bump," the compound springs, shown

at the head and foot, effectually checking any tendency to this.

As will be seen, the method of suspension is briefly as follows:—Brackets, made fast to the bulkheads of the cabin, carry suspended bearings, in each of which the ball and socket joint rolls. From these balls, as joints, are hung cross pieces, like a walking beam, at the head and foot of the berth, the four corners of which are connected to the arms of the cross pieces by suspension links, jointed at every point of connection, as shown.

The compound springs, attached to the head and foot and to the floor, as shown, consist each of a weak and strong spring, a moderate roll or pitch bringing the weaker spring only into play, while a heavy pitch, or "header," brings both springs into action, thus bringing the check to bear gradually.

This method of suspension and spring control is equally effective whether the vessel be simply rolling or pitching, or whether she be indulging in those peculiar sorts of curvetting motions, the passenger's horror, known as cross pitching.

The two light rods shown admit of a curtain being drawn, so ensuring that the occupant of the berth does not observe any of the motion going on outside it.

We may state that Mr. Goodwin has received several orders to fit these berths on passenger steamers and on yachts (amongst others, the new Governor of New Zealand is having his cabin for the voyage out fitted, the berth being so arranged as to allow of its afterwards being transferred to His Excellency's yacht), and we trust he may receive that encouragement from owners which his invention seems to merit.

THE PROPOSED SYMINGTON MEMORIAL.

WE are pleased to note that *at last* there is every prospect of a fitting and worthy memorial being raised to the memory of William Symington, the man who (like Watt with the steam engine) brought steam navigation from the ephemeral fancies of the theorists to the accomplished fact of practice. That Symington was the first man who *thought* of putting a steam-engine in a boat we should not like to assert, but that he was the first man to practically show the feasibility of steam navigation, we do most emphatically maintain, and we have undeniable evidence to bear us out in our assertion, and we only regret that almost exactly a century has been allowed to pass away since Symington's first efforts at steam navigation without his name meeting with some substantial recognition and perpetuation at the hands of his too negligent fellow-countrymen of the United Kingdom, for surely no narrow thought of nationality should stand in the way of doing honour to the memory of such a man. It may not be generally known that Symington died a disappointed, broken man in London, and was interred in the old churchyard of St. Botolph, Aldgate, on March 25th, 1831, no memorial serving to mark his resting-place. Needless to say, by the time of his death steam navigation had made immense progress, but all the recompense a grateful (?) country ever made to the originator of this enormous source of national wealth was "a gift of £100, and a pension of £50 for one or two years."

It may not be considered out of place here, passing over Symington's earlier efforts at steam navigation, made almost exactly a century ago at the desire of Mr. Miller, of Dalswinton, if we briefly describe the first steamboat having what might be safely called commercial importance, and from which it is not too much to say the present magnificent liners trace their direct descent.

The *Charlotte Dundas*, for the illustration of which we are indebted to Mr. James Stevenson, C.E. (who is warmly taking up the cause of the memorial in London), was built at Grangemouth in 1801 by Alexander Hart. She was 56 ft. long, 18 ft. beam, and 8 ft. deep. "There was a cavity in the stern and in the middle of the breadth of the boat, open behind and below, measuring 4 ft. wide and 12 ft. long, for the paddle-wheel to work in." She was steered by two rudders connected by iron rods.

The engine was 10 H.P., and on trial, during a boisterous day, she towed two 70-ton barges in the teeth of the gale out from Lock No. 20 on the Forth and Clyde Canal, reaching Port Dundas, Glasgow, in six hours, the distance being 19½ miles, and the speed at the rate of 3¼ miles per hour. Should our readers desire further proof of Symington's claims upon their gratitude, we would refer them to the very influential Committee which has been formed in Grangemouth, with Chief Magistrate Macpherson and Mr. H. Adolph Salvesen, steamship owner, as joint Secretaries.

Perhaps we could not more fittingly close this necessarily brief notice than by quoting the concluding paragraph of the circular issued by the Grangemouth Committee:—

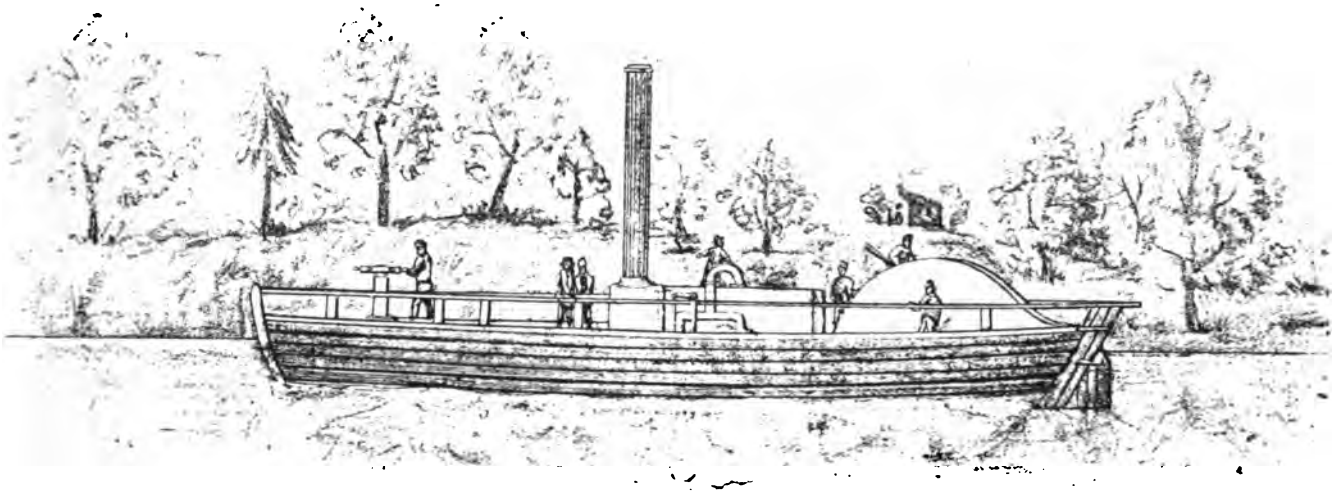
"Surely it is more than time that some public recognition were given to the half-forgotten genius and unrequited services of Symington, who by his rare invention has done so much for the commercial prosperity of his country. This circular is issued to secure in some shape a public memorial to this Scottish engineer and his skilful application of steam to the propulsion of vessels, that now continually navigate every river, lake, and ocean in the world. What shape such a memorial may assume must be submitted to the judgment and decision of the subscribers.

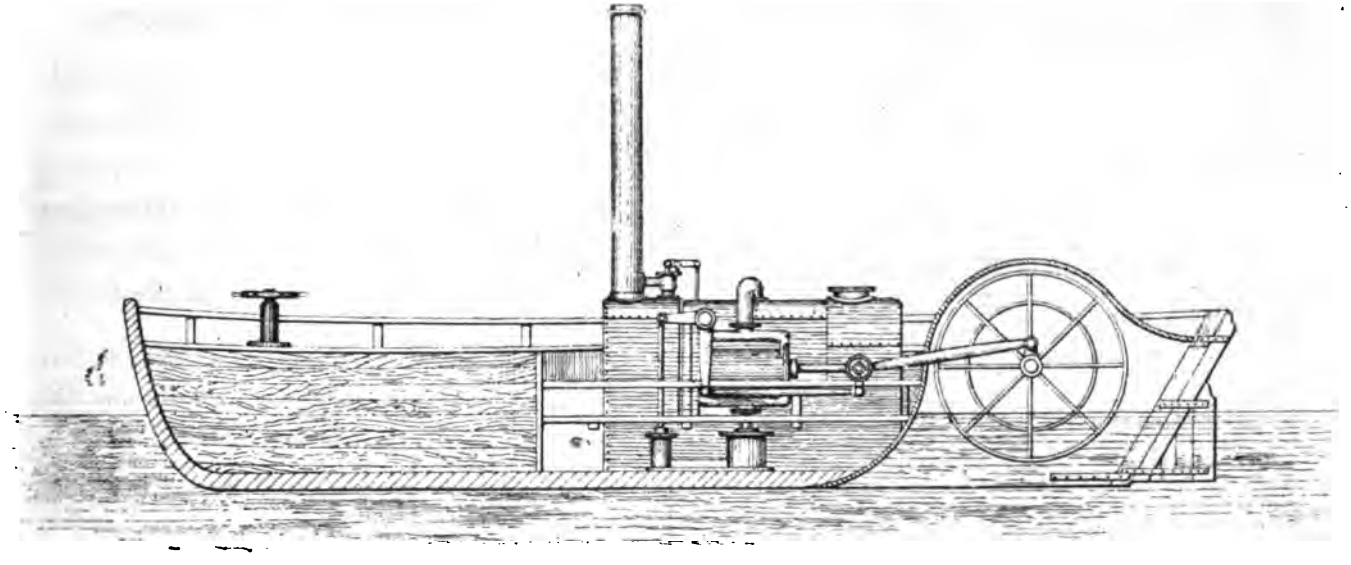
"The Committee trust you will contribute to the fund and intimate the amount to Messrs. J. S. Mackay & Son, Commercial Bank of Scotland, Grangemouth, or to either of the Secretaries."

Amongst the subscribers so far we notice the following:—Earl of Zetland, £15; Earl Ravensworth, £2; T. D. Brodie, Esq., £10 10s.; James Currie & Co., Leith, £10 10s.; James Rankin & Son, £3 3s.; H. Macpherson, Esq., Chief Magistrate, Grangemouth, £5 5s.; J. T. Salvesen & Co., £5 5s.; P. Denny, Esq., Dumbarton, £5 5s., &c.

We trust that our readers will help to swell the list of contributions.

In a recent report on the collapse of some boiler flues, Mr. W. Parker states that about 2 cwt. of solid matter will be deposited in the boilers per 1,000-horse power if sea water is used for make-up feed.





"THE CHARLOTTE DUNDAS."

THE FIRST PRACTICAL STEAM BOAT RAN ON THE FORTH AND CLYDE CANAL, 1801.

A NOVEL SYSTEM OF CANAL TRANSPORT.

WE recently inspected, at the offices of Messrs. Pickard Brothers, of 114, Newgate Street, London, E.C., the models illustrating a novel and very interesting system of canal transport, of which Mr. Arthur Pickard, of Leeds, is the inventor.

As we propose fully describing and illustrating Mr. Pickard's system in an early issue, we will now only briefly call attention to the system, which consists in simply making the water of the canal itself supply the power to propel the vessels floating on it, in place of the usual system of propelling or hauling them by engines or horses, as the case may be. This is accomplished by dividing the canal longitudinally, so as to form it into two conduits, as it were, and placing at one end of a given length, or level, a powerful fan, or screw propeller, the fan being placed in an aperture in the dividing wall, and driven by a steam-engine, a similar aperture at the other end of the length allowing the water to pass in an uninterrupted stream from one conduit to the other, hence, on the fan being set in motion, it causes the water to flow up one conduit and down the other, the boats, or carriers, which are tank-shaped, with flat bottoms and square ends, are thus carried by the current either up or down the canal, as may be required. The carriers are mounted on wheels, so that they may be run direct from the water upon inclines, and so to the land, where, being placed on rails, they would be conveyed to the works to be loaded or unloaded. The use of locks is avoided, provision being made for lifting the carriers from one level to the other.

In designing this novel method of transport, the inventor has specially in view the working of short lengths of waterway in some of the coal, iron, and other mineral districts, though, of course, needless to say, there are numerous purposes for which the system seems peculiarly applicable—Mr. Pickard, amongst other applications, proposing the construction of tank, or built-up canals, on the surface of the ground, in level localities.

THE FASTEST WARSHIP.

THE United States dynamite-gun cruiser *Vesuvius*, built by the William Cramp's Sons' Shipbuilding Co., of Philadelphia, made her third official trial trip on January 11th, over a course beyond the Delaware breakwater, and gained a record of 21·64 knots per hour, entitling her to the position of the fastest cruising war vessel in commission. The details of the trial were embodied in the following report by the contractors:—

"Leaving the shipyard on the morning of January 10th, we ran the *Vesuvius* to the Delaware breakwater, arriving there at 2.45 p.m., and reported to the Examining Board, Lieutenant W. S. Cowles, President. Desiring to obtain certain data of performance for our own use, we decided to spend the rest of the afternoon of the 10th in a series of progressive speed trials, and hence deferred the official trial until January 11th, with the consent of the Board.

"The length of the course as measured was certified to us by the Board as being 2·54 knots, and we were notified that the *Vesuvius* would have to go over it in 7 min. 37 1-5 sec. each way, in order to attain the mean speed of not less than 20 knots an hour required by statute. The first run over the course was in the direction of the tide, and was made in 6 min. 39 sec., which gave a rate of 22·95 knots per hour. The second run against the tide was made in 7 min. 30 sec., showing a rate of 20·35 knots per hour. The mean speed of the two runs was therefore 21·65 knots per hour. A gratifying circumstance being that the statutory requirement was handsomely exceeded in each run. The I.H.P. developed by the main engine was 4,295, and, estimating the auxiliary at 150 I.H.P., the total was 4,445."

The vessel on its trial carried the Naval Board, consisting of Captain W. S. Cowles, commanding the United States steamer *Despatch*; Lieutenant Seaton Schroeder, Lieutenant Bradley A. Fisk, and Past Assistant Engineer Habighurst. There were also William Cramp, Andrew Cramp, Horace Lee, Lieutenant Carden, of the United States Revenue Marine; Walter Cramp, and A. C. Buell.

Prior to this trial of speed, the *Queen Regent*, of the Spanish Navy, constructed by the Thomson Shipbuilding Co, of Clyde Bank, Scotland, had the record of the fastest cruising man-of-war afloat. She was guaranteed to make 20 knots an hour, and at her seventh official trial she made a mean of 20·8 knots on a 1-knot cruise. The *Vesuvius* has broken this record by almost one knot on her third official trial. The two previous trials, which were made in December, were over the Ship *John* course, water so shallow that it was then declared that the greatest speed was not attained.

The mean average revolution of the screw was 278·8 per minute, the average steam pressure was 165 lbs, and the mean slip of the screw was ·174. At the highest speed there was no appreciable vibration of the hull, and no heating of bearings. The run was made at about 9 a.m. After remaining at the Breakwater some time a start was made toward Philadelphia against the ebb tide. The engineer was given directions to let the vessel do all she could with natural draught, and the distance of 92 knots to the yards was made in five hours and 43 minutes. The *Vesuvius* will remain for a short time at the yard while work is done to the valve gear of the dynamite gun, and will then go into commission.

She is of the following dimensions:—252 ft. 4 in. length; 26 ft. 5 in. beam; 14 ft. 1 in. depth; draught, 9 ft.; and displacement of 725 tons; triple-expansion engines, contracted to produce 3,000 H.P. It is estimated that she can produce a speed of 23 knots per hour with forced draught.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty, from December 22nd, 1888, to January 24th, 1889.

Agnew, John W., engineer to the *Warspite*, to date January 17th.

Andrew, Wm. J., engineer to the *Conquest*, to date February 1st.

Anstey, William J., engineer to the *President*, additional, to date January 27th.

Ayers, Robert B., assistant engineer to the *Sharpshooter*, to date January 3rd.

Burnes, Thomas, staff engineer to the *Nelson*, to date January 23rd.

Cock, Charles J., engineer to the *Sparrow*.

Cooper, Herbert, assistant engineer to the *Severn*, to date January 5th.

Cox, Herbert B. T., assistant engineer to the *Leander*, to date February 1st.

Crowley, Edward A. E., assistant engineer to the *Thames*, to date January 19th.

Cummings, George R. T., engineer to the *Jackal*, to date January 21st.

Dalrymple, John H., assistant engineer to the *Mohawk*, to date February 1st.

Downer, John M., engineer to the *Vernon*, additional for *Vesuvius*, to date January 23rd.

Fawcett, John, engineer to the *Vivid*, to date January 3rd.

Fedarb, William, engineer to the *Firebrand*, to date January 5th.

Gay, William H., chief engineer to the *Sphinx*, re-appointed on promotion, to date December 8th.

Gilbert, James H., chief engineer to the *Cossack*, to date January 1st.

Godbeer, Samuel, assistant engineer to the *Victoria*.

Graham, James E. D., engineer to the *Sheldrake*, to date January 3rd.

Grant, William H., engineer to the *Pelican*, to date January 21st.
Green, Leopold M., fleet engineer to the *Audacious*, to date January 11th.
Hines, William, engineer to the *Asia*, additional, to date February 1st.
Hornsby, Richard S., engineer to the *Redbreast*, to date January 24th.
Hunt, Isaac E., chief engineer to the *Narcissus*, to date February 1st.
Johns, A. J., engineer to the *Indus*, additional, to date January 3rd.
Kerswell, George T., assistant engineer to the *Seagull*, to date January 3rd.
Liversidge, Edward W., assistant engineer to the *Leander*, to date February 1st.
Meadus, William H., assistant engineer to the *Dart*.
Miller, Matthew R., staff engineer to the *Leander*, to date February 1st.
Moffet, Edward G. P., engineer to the *Victoria*.
Norgate, Robert S. G., engineer to the *Redpole*, to date January 24th.
Nye, Alfred J., engineer to the *Hyacinth*, to date February 1st.
Pallett, William H., assistant engineer to the *Conquest*, to date February 1st.
Perkins, George L. R., engineer to the *Narcissus*.
Rawling, Sylvister, engineer to the *Cossack*, to date January 1st.
Riley, William H., chief engineer to the *President*, to date January 27th.
Silk, Ethelbert S., acting assistant engineer to the *Conquest*, to date February 1st.
Simpson, James W., assistant engineer to the *Cossack*, to date January 1st.
Tilbrook, Charles F. H., engineer to the *Paluma*.
Turner, Arthur W., engineer to the *Colossus*, to date December 22nd.
Wallis, Henry, engineer to the *Leander*, to date February 1st.
Watson, James H., assistant engineer to the *Osborne*, to date January 12th.
Weeks, Edward J. (probationary), assistant engineer to the *Victoria*.
Weeks, G. A., staff engineer to the *Grappler*, additional for Gibraltar Yard.

HOAR & BROWN'S HARDWOOD MARKET REPORT.

TEAK.—The stocks are getting thinner, and if fresh arrivals do not occur the consumers will be having to look abroad for their requirements. Prices have advanced nearly £2 per load. In the London markets we have only portions of Moulmein and Rangoon cargoes offering, viz., "Fiddia D," "Salvatore A," "The Mon" and "Liguri," all of which are shipped as first-class, with the exception of the last-named, which is rather badly butted. The deliveries for the four weeks ending the 18th inst. were 656 loads.

WHITEWOOD.—Logs and planks.—During the last week or so a spurt has taken place, country contracts easing the market considerably, and small parcels of logs offering fetch full prices compared with recent values. Planks have been much sought after privately, keen competition being indulged in.

GREENHEART market still remains firm, and most of the lately arrived cargo will shortly leave the docks and go into consumption; and, considering the short stocks, we are thinking it must be good business for buyers to fill up their requirements.

Stock stands at 296 loads against 1,010 loads in 1887; the deliveries are small, however, being only 24 loads for the last four weeks.

MAHOGANY.—Although the stocks are very light, the market does not improve as one would expect it to do, considering the only landed cargo in Brokers' hands was sold at public sale a week ago. The prices obtained for this cargo were no better than those offered upon the previous occasion, when the principal portion was withdrawn. We presume buyers are waiting to see for certain what this season's Honduras supplies are likely to be; there are whispers that over 3,000,000 ft. are expected, in consequence of floods having at last come pretty heavily. This has evidently got wind, and is no doubt keeping buyers aloof; but there is not so much fear necessary, as the Honduras market is at present completely devoid of stock, with the exception of the usual ringtails, which are generally found at the finish.

The opinion is, the market will want a large supply from Honduras before the prices will be shaken for good wood. Very many orders are being held over for the new arrivals, and the first few auctions will meet with a warm reception.

We may add that Liverpool have been, and are, making some extensive purchases of minimum wood from London stocks.

CEDAR is decidedly looking up, and the large stocks which kept down the market being now nearly all sold, there is nothing left with which to carry on any trade, a few odds and ends constituting the available stock. Prices have increased somewhat, but the advance is checked by consumers being mostly filled up for their present requirements.

WALNUT Logs are still a drug, and large supplies have again shown themselves, mostly of inferior kinds. Prices are low and likely to decline.

Good average imported boards are in demand.

SEQUOIA.—Some large deliveries have been made this week to the Continent, and several smaller sales to the country at fair prices.

HOAR & BROWN'S ANNUAL HARDWOOD MARKET REPORT, January, 1889.

TEAK.—There has been a steady improvement in prices all through the year, having at the close a very firm market, with a stock of only 6,363 loads, being 41 per cent. less than last year.

The following table of figures shows the progress of the business:—

IMPORTS OF LOGS AND PLANKS.

1888—12,270 loads. 1887—8,311 loads. 1886—18,000 loads.

DELIVERIES.

1888.

	Logs.	Planks.	
Moulmein ..	8,712 loads.	1,276 loads.	Loads.
Rangoon ..	1,323 ,,	823 ,,	16,600
Bangkok ..	3,747 ,,	719 ,,	

1887.

	Logs.	Planks.	
Moulmein ..	6,705 loads.	847 loads.	Loads.
Rangoon ..	1,724 ,,	222 ,,	12,190
Bangkok ..	1,643 ,,	1,049 ,,	

STOCKS.

1888.

	Logs.	Planks.	
Moulmein ..	2,980 loads.	621 loads.	Loads.
Rangoon ..	1,433 ,,	425 ,,	6,363
Bangkok ..	522 ,,	382 ,,	

1887.

	Logs.	Planks.	
Moulmein ..	6,961 loads.	398 loads.	Loads.
Rangoon ..	1,165 ,,	168 ,,	10,780
Bangkok ..	1,887 ,,	201 ,,	

1886.

	Logs.	Planks.	
Moulmein ..	7,973 loads.	597 loads.	Loads.
Rangoon ..	2,274 ,,	215 ,,	14,669
Bangkok ..	2,741 ,,	869 ,,	

These figures must be regarded by all interested as very satisfactory, but with reference to the future the prospect is not so encouraging. The prices which have ruled during the past year have been at a standard that has caused the introduction of teak wherever possible, and although on the surface everything appears to favour the inflated ideas which shippers have lately contracted, it is to be hoped they may not succeed in establishing the prices they now quote, which, if realised, can only result in promptly demoralising the market and causing many consumers to seek a substitute. Although the amount of tonnage afloat (20,000 loads) is large, the fact of the greater part of it being sold must not be overlooked (the supplies to H.M. dockyards alone absorb about 6,600 loads), leaving but a small percentage for the open market.

The large consumers having covered their requirements makes the future somewhat uncertain, and in the face of the large amount of tonnage taken up (26,000 tons), prices can only advance if the active demand which has recently prevailed is maintained.

It must be borne in mind that these figures represent the supplies to Europe, and, although they may yet be augmented, they are only on a level with the quantity imported during 1888, viz.:—

From Moulmein and Rangoon .. about 36,000 tons.
,, Bangkok .. .. .. ,, 11,000 ,,

The major portion of engaged tonnage will not arrive until the latter part of the year.

At the present ruling prices buyers would do well to cover their engagements, as there can be no doubt the market must remain very firm for the next few months.

GREENHEART.—The demand until lately has been small, but at the moment is very active, the stock being exceptionally light. Cargo prices have so far advanced as to make speculation doubtful, and the only large buyers are those under engagement.

Landings for 1888 ..	516 loads	against 805 loads	last year.
Deliveries ,, ..	1,230 ,,	426 ,,	,,
Stock, 31st Dec., 1888 ..	296 ,,	1,010 ,,	,,

CANADIAN WOODS.—The imports have been on a very restricted scale, the extraordinary advance in freights preventing shippers from forwarding any timber other than that contracted for. The stocks of yellow pine, elm, and oak, at this season of the year are the smallest within our recollection, and leave holders in a very strong position. Ash and walnut have been very dull of sale on account of the high prices asked. Quebec walnut is not sought after as it used to be, and the prices at which the "States" wood has been selling have practically shut Canadian out of the market.

MAHOGANY.—The past year has been a very satisfactory one with holders, and a brisk trade has been done, prices being firm at the early part, and the demand increasing as the season advanced helped to force prices up to a high standard. There has been a short supply of Honduras all through the year, especially during the latter months, when buyers, finding themselves in a corner for wood to execute outstanding engagements, were eager bidders both for cargoes afloat and at public auction, causing a considerable advance in prices.

The imports and stocks have not been so light as at present for the last 15 years, which fact, combined with the large contracts still unexecuted, will cause a very strong demand for the arrivals which are expected during February and March.

The Cuba imports sold well at the commencement of the season, and a large business was carried on, but numerous shipments arriving during the summer, this activity appeared to die off, and since then a very shy trade has been done, although good stocks still remain in the hands of both dealers and brokers.

		Landings.	Deliveries.	Stock, 31st Dec.
Honduras	1888.....	5,227 logs	7,974 logs	762 logs
Mexican	,, ...	9,069 ,,	9,344 ,,	2,808 ,,
Cuba	,, ...	11,050 ,,	8,598 ,,	2,540 ,,
St. Domingo	,, ...	1,774 ,,	1,818 ,,	42 ,,

CEDAR.—A steady demand has continued, and in consequence of importations falling off, and stocks being greatly reduced, a slight rise in prices has taken place. With a further demand they will advance considerably, leaving the market very bare. The landings during the last three years have been as follows:—

		Landings.	Deliveries.	Stock, 31st Dec.
Cuba	1886....	759 logs	801 logs	3,141 logs
	1887....	166 ,,	2,019 ,,	1,288 ,,
	1888....	911 ,,	1,226 ,,	973 ,,
Honduras, &c.,	1886....	2,987 ,,	1,933 ,,	3,199 ,,
	1887....	932 ,,	1,703 ,,	2,428 ,,
	1888....	382 ,,	1,597 ,,	1,213 ,,

SEQUOIA.—The demand has increased, resulting in a considerable turnover, and stocks are greatly reduced, only one parcel remaining unsold in the United Kingdom. Prices were steady through the year.

SATINWOOD.—The importation has been small. Figury logs are required, and would fetch good prices. Small wood sold well towards the end of the year.

AMERICAN WALNUT.—There has been a large consumption of this wood, both of prime and inferior stocks, owing principally to the excessive importations which crowded the market during the summer months, when a large amount of business was transacted in consequence of prices being considerably below the usual standard. Since this time very few large contracts have been made, with the exception of one or two for prime parcels. The imports of planks and boards have seriously interfered with the log trade, the demand for the former increasing every year, especially for medium quality, the low price allowing the imported cut stuff to be used at less cost than logs, size for size. The arrivals and deliveries are as follows:—

	Arrivals.	Deliveries.	Stock 31st Dec.
1888 ..	6,092 Logs. ..	5,654 Logs. ..	2,862 Logs.

AMERICAN WHITEWOOD.—Logs are a drug upon the market at present, no business of any importance being done. The forced auction sales have caused some damage, but as the stocks are held by a very few members of the trade, prices will not be allowed to suffer such disaster as might have been the case. Further supplies are not required at present.

AMERICAN QUARTERED OAK.—Very large transactions have been carried through during the year in planks and boards at low figures, and stocks are still heavy.

SATIN WALNUT.—Shippers of this wood have lost considerably, large stocks remaining on hand during the early part of the year. The greater portion was sold at ruinous prices, leaving a light stock at the present time, consisting of a few logs, two or three parcels of planks, with some boards. Prices have recently improved somewhat.

The gradual but steady character of the improvement in the hardwood and timber trade generally is very gratifying, leaving the business on a secure basis, and the new year opens with more favourable prospects than has been the case for some considerable time.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

IN last issue a full account was given of the work completed by the Clyde shipbuilders during 1888, and it was thus indicated briefly that there was a gratifying amount of work on hand and to begin with. Since the beginning of the year—or rather since the article referred to was written—several important orders have been booked. Briefly stated, the amount of work on hand at the present time, and the new work on order, is represented by about 280,000 tons and 240,000 effective H.P. of engines. At the beginning of 1888 the tonnage on hand was 225,000; at the corresponding date in 1887 it was 120,000, and in 1886 it was 130,000. From these figures, it will be seen that Clyde builders and engineers have good reason to feel satisfied with the amount of work before them. The more important contracts being executed are a 6,700-ton steamship for the Red Star Line, under construction in the shipyard of Messrs. J. & G. Thomson, Clydebank; a 5,300-ton steamship for the Pacific Mail Steam Navigation Co., building in the Fairfield yard; a steamer of like tonnage, building by Messrs. Robert Napier & Sons, Govan, for the Royal Mail Steam Packet Co., sister ship to the *Alsato*, recently finished for the same company; two new North German Lloyd's steamships, each of 5,500 and 6,000 effective H.P., building by the Fairfield Co.; and four steamers of 3,500 tons each and 2,000 H.P., building by Messrs. Caird & Co., Greenock, for the Peninsular and Oriental Steam Navigation Co.

Clyde shipbuilders have succeeded in securing a large proportion of the new shipping to be called into existence by the formation of a German Co., established to run steamers between Hamburg and Calcutta. Two vessels have been ordered, and largely owing to the German shipyards being fully occupied, and the period of delivery being short, the Clyde builders have secured three out of the five vessels at present to be constructed. The vessels are to be of about 3,000 tons gross register, and will have engines of the triple-expansion type of 1,700 I.H.P. The remaining two will be built and engined in Germany, one at Kiel, and the other on the River Elbe. The London and Glasgow Shipbuilding Co. are to build and engine one vessel, Messrs. Barclay, Carle & Co., Whiteinch, will build and engine a second, and the third will be constructed by Messrs. Connell & Co., Scotstown, and engined by Messrs. David Rowan & Son, Glasgow.

For the Clyde coast summer passenger service some new steamers are under construction, and alterations are being effected on several of the vessels already established on this important service. Two first-class speedy steamers are being constructed for the Caledonian Railway Co., by Messrs. Caird & Co. (Limited), and Messrs. Reid, Port Glasgow. The company have also purchased two of the Kilmun boats, with the

view of having a regular service from their new Gourock Pier during the coming season. The new vessels will be speedy, and will very probably secure a large share of the traffic between Glasgow, Dunoon, and other coast towns. Several of the old vessels are being placed in the hands of builders for renovation, and in one or two cases new boilers are being fitted on board. Messrs. Hutson & Corbett, engineers, are altering the engines of the well-known steamers, *Jeanie Deans* and *Diana Vernon*, to the surface-condensing type.

The scheme of awards to workmen for inventions, which has been in force in Leven shipyard, Dumbarton (Messrs. W. Denny & Bros.), for a period of nine years, seems to meet with increasingly encouraging results. The report for 1888 of the specially-appointed committee, shows that during the year there had been 38 claims sent in by workmen for improvements in machinery for new designs, or for alterations, whereby production was hastened and improved. Of the total, 20 had been found worthy of award, 14 had been rejected, one withdrawn, and three deferred. The number of new claims received during the year is a little under that of last year, but the number of successful claims is a third greater. The sum of £59 has been expended in ordinary awards, and a further sum of £75 in four premiums, which were earned by workmen. The total sum expended is £55 greater than that of last year. As in former years, with the exception of the last, the workmen in connection with the carpenter and joiner departments have this year received one-half of the awards. Since the inauguration of the scheme no less than 14 claimants have received premiums, and have respectively been paid the following sums, viz.:—£96, £68, £59, £50, £42, £41, £39, £38, £36, £34, £34, and £24; in all £650. These figures show in the most convincing manner the good the scheme has done, and is still capable of doing to all possessed of skill and perseverance, and willing to use their powers in furthering its objects. The Fifth Annual Report of Messrs. Denny & Co.'s Engine Works Award Committee has also been made up. During the past year 12 new claims, and one postponed claim, have been considered by the committee. Of these, five have been found worthy of award, seven have been rejected, and one is still undecided.

Messrs. Ramage & Ferguson, of Leith, are busily constructing, with other vessels, the largest steamer ever built at that port. They have also recently received an order from Messrs. James Currie & Co., Leith, for the construction of two steamers, of 1,200 tons each, for their Continental trade. The Grangemouth Shipbuilding Co., in their shipyard at Grangemouth, and their recently-acquired shipyard at Alloa, are actively progressing with the large amount of work they have on hand. This comprises seven steamers, aggregating 8,900 tons, three of which are each 1,800 tons.

Messrs. W. P. Thompson & Co., of Dundee, have acquired the shipyard, hitherto occupied by Messrs. Pearce Bros., in which they will commence operations at once. Messrs. Thompson have a large amount of work on hand in their Caledon shipyard—5 steamers, aggregating 7,280 tons—and they have recently contracted with the Cork Steam Shipping Co. to build for that company a steamer of 1,100 tons gross. One of the vessels on hand is a steamer of 3,350 tons, for the Clyde Shipping Co.

At Aberdeen, Messrs. Hall, Russell & Co. have five vessels on hand—three of them steamers of 1,800 tons each—and in their engine works they are converting the engines of a Glasgow steamer to the triple-expansion type. Messrs. A. Hall & Co. have now four vessels on hand—two steel steamers, a large sailing ship, and a steam trawler.

During 1888 a very large number of small craft were produced on the Clyde, and a considerable amount of this class of work is presently on hand. Messrs. Alley & McLellan, and Messrs. Mechan & Sons, together, produced no fewer than 76 "vessels" during the year, the total tonnage being only 2,330. The work of the latter firm chiefly consisted of launches and ships' boats, built of thin steel. They have now on hand several good orders for these small fry, and a 40-ft. launch. Mr. Thomas Orr, Greenock, has on hand six steam launches of 28 ft. in length, the machinery for which is being supplied by a Greenock firm. For submarine and mining purposes, Mr. R. Roger, Port Glasgow, is constructing 12 boats, 30 ft. long by 10 ft. beam. The most noteworthy craft of this smaller order, being constructed on the Clyde, is a launch to be driven by electric power, building by Mr. J. Adam, Greenock.

As a natural consequence of the activity in shipbuilding and boiler-making, the various steel manufactures are having a brisk time of it. Shipbuilders complain of the slowness of delivery, notwithstanding the extra efforts at rapidity of output of the steel makers. The Steel Co. of Scotland at their two works—Blochairn and Newton—and Messrs. Colville, of Dalzell Steel Works, Motherwell, are taxed to the uttermost. Messrs. Beardmore have lately lit two more furnaces at Mount Vernon and Druntpellier, thereby materially increasing their already large capacity for output. The new Clyde Bridge Steel Works have been kept extremely busy since their commencement, and have a turn-out of over 2,000 tons of steel monthly. The Brandon Iron & Steel Works at Motherwell, which have been stopped for over a year, have been recently purchased by a new company, and are about to be re-started. They are capable of turning out over 800 tons per month. The large works of Merry & Cunningham at Glengarnock, which were erected for the manufacture of steel on the Basil system, have been re-started after some extensions and alterations. An extra large contract, it is said, has been booked by Messrs. Merry & Cunningham for home consumption. With the introduction of the complete system of utilising the bye-products in the manufacture of iron, the flames which shoot out from the smelting furnaces of William Dixon (Limited) will shortly be almost suppressed. Thus will disappear a prominent night-mark of Glasgow, which has been known for the past 50 years by the familiar title of "Dixon's Blazes."

TRADE NOTES FROM THE TYNE, WEAR, TEES, &c.

The Tyne.—Since the advent of the new year the shipbuilding trade of the district has passed through a crisis of more than ordinary importance. A claim for an advance of 12½ per cent. on piece wages, and 3s. per week on time wages, was sent to the employers early in the month, on behalf of the members of the Boilermakers' and Iron Shipbuilders' Society, and as it was pretty well understood in commercial circles that the condition of the trade was not such as to admit of so large an addition to the cost of production, fears were entertained that the disaster of a general strike might be the outcome of the demand. The wise practice, however, of meeting for an interchange of views was resorted to on this, as on former occasions of a like nature, by the employers and the representatives of the men, with the gratifying result that a settlement, which practically covers the operations of the whole year, was brought about. Two meetings were held at Newcastle and Sunderland respectively, at the first of which (presided over by Mr. Arthur Coote, of Messrs. R. & W. Hawthorn, Leslie & Co.), an offer of 5 per cent. was made, but not accepted. At the second meeting (presided over by Mr. James Laing), this offer was repeated, and was supplemented by the promise of an additional 5 per cent. at the beginning of July. It was also intimated at this meeting that the time wages would be advanced 1s. per week concurrently with the first advance on piece wages, and 2s. per week on present rates when the second advance became due in July. The representatives of the workmen being evidently impressed with the facts and arguments adduced by the employers in support of their proposals, agreed unanimously to the arrangement as outlined above, and a settlement was thus effected which, while it gives to labour a substantial increase of remuneration, places the employers in a position to negotiate for contracts during the next twelve months with comparative freedom and safety. Other classes of operatives may, of course, be expected to follow suit with claims for advances, but as a precedent to be followed has already been established in the case of the most numerous and important body, very little trouble is anticipated in connection with the settlement of other claims that may arise. The present condition of the trade—to which reference has been incidentally made in the foregoing remarks—may be briefly defined as follows:—Orders abundant—so much so, indeed, that all the builders in the district are fully supplied to the end of the year; but prices so low as to leave but a scarcely appreciable margin of profit. Prices have recently stiffened somewhat, and it is satisfactory to be able to state that a large part of the work contracted for during the past two months has been taken at the advanced rates. By the time the shipbuilders will have to begin paying 10 per cent. higher wages, it is expected that most of the low-priced orders will have been worked off, and the work then re-

maining to be done will be better able to bear the enhanced cost of execution. At the Hebburn Shipyard (Messrs. R. & W. Hawthorn, Leslie & Co.'s), the volume of work is now greater than for many years past, and every berth is filled. With a view to further enlarge the productive capacity, and render themselves able to fulfil all prospective engagements, they have lately added to their plant some new machines of an exceptionally powerful type, and they are evidently determined to maintain the position in the very front rank of shipbuilders that they have long occupied. Sir W. G. Armstrong, Mitchell & Co. are erecting a new building, to be utilised for the "drafting" of vessels at their Low Walker yard. The additional accommodation was made necessary owing to the extension of their frame-bending department. At their Elswick yard seven berths are occupied, but nearly all the vessels are yet in backward stages, and there is consequently not much scope for the employment of labour. Messrs. Palmer have had a couple of launches since the opening of the year, and there is every reason to expect that they will repeat the achievement every month of the remaining eleven. Should this estimate be correct, the output will be considerably larger than that of last year, as the vessels to be built are, in the aggregate, of much heavier tonnage. Messrs. C. S. Swan & Hunter have commenced the construction of a vessel at their "east" yard, which was opened out by them in 1883, but was closed in 1884, and has since been practically inoperative. They have four large vessels in course of building in their "west" yard. The adjoining yard of Messrs. Schlesinger, Davis & Co. has just been greatly enlarged, and every available piece of building space is occupied. Messrs. Dobson & Co., Low Walker, have also made an extensive addition to the area of their establishment, and have put up a new jetty, to be used for delivery of material and other purposes. The whole of the repairing works are now very busy, some important contracts having recently been brought to the port.

In the Marine Engineering trade an advance of 2s. per week in the wages rate has been asked for on behalf of the operatives, the term of notice to expire on February 4th. In some of the repairing shops an advance has already been conceded. It is expected that in this case, as well as in the case of the shipbuilding operatives, an amicable settlement will be arrived at. With reference to the state of work in the various establishments, the only description that is applicable is that the general briskness is fully sustained. Ironfounders continue to be offered more work than they can deal with, and in this branch of business there is a very marked scarcity of skilled operatives. Brassfounders and coppersmiths are also overburdened with orders, and are very generally resorting to exceptional measures to meet the requirements of customers. Makers of ships' lamps and all other articles required for the outfit of vessels are doing an active trade. Messrs. John Abbot & Co., who are at present very busy in all their departments, are, it is stated, about to add the manufacture of steel castings to their other branches of business. The Newburn Steel Works are, if anything, busier than at the close of last year, the anchor shop being noticeable as among the most active departments of this exceptionally active establishment. The Redheugh Sheet Iron and Steel Works are kept briskly going, orders for the classes of goods manufactured being abundant, and prices improving. Manufacturers of angle bars and ordinary merchant iron are able to keep their mills going steadily, and makers of bolts and rivets for ship and boiler building purposes are receiving as many orders as they care to accept. At the various rope works business continues good, the demand for wire rope required in connection with steamers' rigging being specially brisk. Saw-mills and timber preserving works are much busier than they were a year ago, but the arrivals of timber cargoes at the docks have, during the past few weeks, been few and unimportant. In the steam coal trade an improved business has been steadily manifesting itself during recent weeks, and prices are now showing a substantial advance. A demand for a 10 per cent. advance of wages has been made on behalf of the miners, and the coal owners have promised to give it their consideration. The colliery engineers have asked for an advance of 4d. per day. It is probable that both these claims will be settled by compromise, and that a stoppage of work will be avoided.

The Wear.—The wages settlement, respecting which details have already been given, applies to the Wear as well as to the Tyne, the shipbuilders on both rivers being united in one association. An arrangement by which the shipbuilders on the Tees and at the Hartlepools, will, from the 1st of February, be affiliated to the same body, has been entered into, and one result of this combination will probably be that wages rates at the different centres will become more nearly assimilated. The shipwrights engaged at the wood-work in the Wear yards have given notice that they will require an advance of 3s. per week on the wages rate after February 13th. As this body is connected with the Conciliation Board, it is, however, expected that the claim will be settled amicably. A question respecting the docking of vessels, in which the shipwrights are concerned, is to be settled by two referees, appointed by the employers and the men respectively. The referees will appoint an umpire, whose decision in case of difference between the referees, will be final. During the first month of the year very few orders were booked by Sunderland shipbuilding firms, but this circumstance is not regarded with dissatisfaction, as all of them were well provided with orders when the year commenced. At the time of writing, inquiries are not particularly numerous, but it is expected that a renewed stimulus will be given to business when a few more weeks are passed and North Sea navigation is again resumed. In any case, very few additional orders can be booked by builders in this district, in respect of which stipulations are sought to be imposed for delivery in the present year. Messrs. J. L. Thompson & Sons, who in the matter of output headed the list of Wear builders in last year's returns, with the respectable figure of 35,321 tons, are certain not only to repeat, but to surpass the achievement in the present year. In addition to the new work turned out, the firm did an immense amount of repair work last year, and according to present appearances they are likely to do at least as much during the present year. They are now engaged in lengthening the s.s. *Meath* in one of the Wear Commissioner's graving docks, and they have also extensive repairs to carry out to the stem and stern of the vessel. A large steamer has arrived at the Manor Quay Works to be altered from the well-deck to the spar-deck type, and several other contracts of the same kind are to be executed during the next few months. The firm are putting down a very powerful steam-hammer and other effective appliances at their Pallion forge, which has recently been enlarged by the addition of a new smith's shop. Messrs. Short Brothers, who occupied the honourable position of second on the output returns last year, enjoy the distinction of having made the first launch for the present year. The vessel put off the stocks was built to the order of Messrs. Taylor & Sanderson, and is the sixteenth supplied to them by the same builders. Messrs. Short Brothers are, in common with the other principal firms on the river, putting down additional plant of the newest kind, and are in other ways improving their productive facilities. The splendid vessel which Mr. Laing is building for the British India Steam Navigation Company is now well advanced towards completion, and will probably be ready for launching about the beginning of May. Both Mr. Laing's graving docks are occupied with vessels undergoing repair, and indeed, it may be stated, that they are scarcely ever empty. Messrs. R. Thompson & Sons have just completed the extensive repairs they were commissioned to carry out to the hull and engines of a large steamer, formerly called the *Hector*, but which will in future be known by the name of the *Westpool*. The vessel having been thoroughly overhauled, may be looked upon as practically a new steamer, and though built over 20 years ago, is likely to last out as many years' wear and tear as some of those that are now being put off the stocks. It is safe to say that the Sunderland Shipbuilding Company will, in the year which has now been entered upon, be able to place on record the largest output of tonnage yet attained by them. The reasons for venturing upon this forecast are, that they have in the first place a more than ordinarily large number of orders on their books, and that they have, besides, an aid to production of the most important kind in De Bergue's system of rivetting by air pressure. This system, which was adopted by the firm in the later months of last year, is now being pretty extensively applied, and by its use the framing of vessels is being immensely expedited. To the initiated it is unnecessary to say that exceptional rapidity in the framing of vessels, must constitute an important factor in the realisation of a satisfactory output.

The resources of the Marine Engineering establishments continue to be severely taxed to meet the requirements of customers, and though, from the manufacturer's point of view, prices may not be all that could be desired, the volume of trade is unquestionably as great as the most exacting could wish to see it. The trial trip of the large passenger steamer *Conde Wifreda*, which was built by Messrs. J. L. Thompson & Sons, and

engined by Mr. John Dickinson, is being actively prepared for, and little doubt is entertained that the result will prove satisfactory. The manufacture of Dickinson's patent crank-shafts continue to add materially to the briskness at the Palmer's Hill establishment, and this speciality appears to be every day coming into greater favour among engineers and ship owners. Messrs. William Allan & Co., of the Scotia Engine Works, are receiving numerous inquiries for the special type of marine engine they propose to manufacture, and daily increasing activity is to be noticed in the various departments. The steam winch and steam steering gear manufactories are exceedingly busy, and in many instances new orders have to be declined. Iron and brass founders are fully as busy as they have been at any former period. The same description applies with equal accuracy to the forges, the work in course of execution at these establishments consisting mainly of steamers' keels, stern frames, &c., and heavy engine shafting. The pressure of work at Messrs. Tyzack & Co.'s rolling mills is very great, a large proportion of the orders in hand having been obtained from local shipbuilding firms. It has now been officially declared that the Castletown Iron Works (or Steel Works, as they are in future to be known) will not be ready for a commencement of operations till early in June. The demolition of the old buildings is nearly completed, and the necessary excavations for the putting down of steel plant have been commenced.

The Hartlepools.—Messrs. W. Gray & Co. have made their first contribution to the year's output by launching a large vessel from their new Central Shipyard. Other launches will speedily follow, as the firm have two or three vessels in advanced stages at their older establishment, besides several that have been laid down at a comparatively recent date. With this firm the transition from the earlier to the later stages of building is very rapid indeed, and it may be predicted with some confidence that they will this year, as they did last, outstrip all competitors in the matter of production. Messrs. Withey & Co. have all their berths full, and in their case also the indicators point to the realisation of a good year's work. A temporary stoppage of work exists at the time of writing, owing to the refusal of the platers, rivetters, &c., to accept the employer's offer of an immediate advance of 5 per cent. on piece-work with a subsequent advance of another 5 per cent. at the beginning of July, but it is highly probable that a settlement will be arrived at by the time these notes are in print. The men have turned out against the wish of their society officials, and this circumstance makes it pretty certain that they will not long maintain their attitude of resistance. Night work at the Central Marine Engine Works, has been discontinued for the present, but will immediately be resumed when the shipyards dispute is at an end. At a time when marine engineering establishments all over the country are full of work, it is almost needless to say that a concern having the reputation of Messrs. T. Richardson & Sons', is as actively employed as it is possible for any establishment of the kind to be. The forging department is just as busy as the fitting and machine shops, and throughout the whole of the extensive works the greatest activity prevails.

Stockton.—The Stockton shipbuilding yards are temporarily closed for the same reason as those at the Hartlepools. A settlement at the last-named centre would no doubt be accepted by the Stockton men, and whenever a return to work takes place, it will almost certainly be simultaneous in both places. Messrs. Blair & Co.'s Engine Works continue to show a very high degree of briskness, and most of the other engineering establishments, as also forges, bridge works, &c., are doing an active trade. Messrs. Riley Brothers, of the Perseverance Boiler Works, have purchased from the Moor Iron Works Company a piece of land having an area of three acres, which they intend using as a site for a new factory of much larger extent than their present one. The ground is now being cleared, and otherwise made ready for the erection of the new premises, which work will be commenced in the course of a few weeks. The great and rapidly increasing demand for Messrs. Riley Brothers' special types of boilers has made the contemplated extension necessary, and it is quite certain that in determining to remove their business to new premises, they have also determined to provide themselves with every means calculated to ensure the highest possible efficiency in their constructive arrangements.

Middlesbro'.—Messrs. Raylton, Dixon & Co.'s yard, and the other yards at Middlesbro', keep very busy, and at this centre a stoppage of work has been avoided by the decision of the employers to give their workmen in the iron departments an advance of 7½ per cent. instead of the 5 per cent. offered at Stockton and the Hartlepools. This, however, is only a temporary arrangement, and it is understood that whatever settlement is ultimately arrived at in the other centres named will also apply to Middlesbro'. The drillers have had an advance conceded to them on the same condition as that accepted by the members of the Boilermakers' and Iron Shipbuilders' Society. The platers' helpers have made a demand for a similar advance to that given to the platers, but up to the present it has not been favourably responded to. Extraordinary activity is still the feature at the steel works, and iron foundries are as busy as ever. Engineering works are well employed, and boiler and bridge works continue to have a good supply of work. In the crude iron trade, business is somewhat dull at present, but there are indications of a return of activity in the near future.

Darlington.—Owing to the exceptional pressure on their resources, the Darlington Forge Company have found it expedient to start a branch establishment at Wallsend. A new building, specially adapted for the purpose, has been erected on a suitable site, and it is almost needless to say that it has been fitted with every requisite for the successful carrying on of the business. Operations were commenced in the new establishment a few days since, and it is understood that it will be kept very busy for some time to come.

THE MERSEY.

THERE is, unfortunately, but little to report from the Mersey this month as regards new work of the naval architectural or marine engineering order, though there are expectations of early orders in both departments.

Messrs. Laird Brothers' new boiler shop (which has been in course of construction during the past 12 months) in Beaufort Road, Birkenhead, near to the Great Float, was opened with some ceremony in the latter end of December. The main shop for heavy work is 286 ft. long, 53 ft. wide, and 58 ft. high, the roof being supported on massive double cruciform cast iron columns, which also carry the rails for the steam traveller. The shed for light work is 273 ft. long, 46 ft. wide, and 44 ft. high; and the smithy 247 ft. long, 41 ft. wide, and 35 ft. high. The work now in hand consists of six complete sets of cylindrical boilers, having an aggregate boiler power of 20,000 H.P. The two largest boilers are 18 ft. 6 in. long and 15 ft. 4 in. diameter, the weight of each being 75 tons.

There are no freight movements of importance to chronicle this month. A strike of Liverpool seamen, which at one time threatened serious consequences, occurred early in the month, but is now happily passing away, the men having in many cases gained a slight increase of pay.

From the last report issued it is seen that the receipts of the Woodside Ferry passenger traffic are decreasing, but there is an increase in the goods traffic returns.

From a return issued by the Custom House officials, it would appear that the shipping returns for Liverpool for the past year, ending Dec. 28th, are very satisfactory as compared with those for the previous year, the increase of the tonnage of inward-bound vessels being 904,382 tons, and of outward-bound vessels 189,595 tons. There was, however, a decrease of 170 in the number of ships inward bound, and an increase of only 13 in the number of outward-bound vessels. The following are the actual returns from Jan. 1st to Dec. 28.

	Reported inwards.		Cleared outwards.	
	Ships.	Tons.	Ships.	Tons.
1888 ..	4,657	5,472,535 ..	3,984	4,906,575
1887 ..	4,827	4,568,153 ..	3,971	4,716,980
Increase		904,382	13	189,595
Decrease	170	....	..	....

After many complaints the Dock Board have at last consented to increase the passenger-traffic accommodation at the Prince's landing-stage and approaches. As soon as arrangements can be made, London passengers' luggage will be examined in London instead of on the stage, a boon which will no doubt be greatly appreciated.

In live stock and fresh meat imports a great increase during last year took place as compared with 1887, the figures for last year being—cattle, 90,154; sheep, 28,874; and quarters of beef, 410,868; showing an increase of 30,195 cattle, 16,869 sheep, and 120,350 quarters of beef.

At the annual meeting of the Liverpool Underwriters' Association the question of cotton fires received serious consideration, and a sub-committee was appointed to go thoroughly into the matter.

Liverpool tug-owners may pride themselves on having not only the "first," but also the "second best on record," the steam-tug *Stormcock* having achieved both these honours for her owners. The longest tow on record being that of the *Stormcock*, when she brought one of Messrs. Donald Currie & Co.'s steamers from St. Helena to the south of England, while her more recent laurels were won by towing the *Ardencaple* from Fernando Noronha, on the south coast of Brazil, to Greenock. Fernando Noronha was left on December 15th, and Greenock was reached on January 18th.

At the sixth ordinary general meeting of the present session of the Liverpool Engineering Society, held on January 9th, at the Royal Institution, Colquith Street, an important paper, by Mr. A. W. Brightmore, was read on the "Application of Atmospheric Air to Produce Motive Power."

WELSH NOTES.

THINGS were quiet in this district at the beginning of the month owing to the Christmas holidays, but it is satisfactory to note that the tone of trade generally has the old, healthy sign, and that prices are firm all round.

The steel works have passed through the usual holiday slackness, and are now showing signs of good business all round, Cyforthfa having been particularly busy since the new year came in.

The Barry Railway has proved a boon to the inhabitants of Barry, Cadoxton and Cogan. It is, however, expected that some weeks must elapse before the Taff Vale Railway Co. will be enabled to run through trains, as the junction at Cogan is not yet completed. It is expected that when the Barry Dock gets into full swing that a great diversion of traffic will set in.

Exports during the first week of the new year were comparatively small from all ports.

An item of interest to our Royal Naval readers will be found in the fact that Mr. J. R. Vaughan, who has recently been acting as first-class draughtsman at Pembroke Dockyard, in charge of the mould loft, has been confirmed in that position by order of the Lords of the Admiralty, *vice* Mr. S. A. Allen, superannuated.

In the early part of the month Roath basin was crowded with large steamers, the collective tonnage of which reached 70,000 tons. Three steamers, the *Idas*, *Ivan*, and *Ivy Shoween Head*, alone, figuring for 20,000 tons out of the total. The vessels named were built by Messrs. Harland & Wolff, Belfast.

A meeting was held at Weston-super-Mare on January 9th, to invite public support for a bill, to carry out the Brean Down Harbour project, in the next session of Parliament. The meeting was influentially supported, and several pertinent questions having been put and satisfactorily answered, the meeting adopted a resolution approving the project. Mr. T. J. Perrett detailed the advantages offered by Brean Down for a mail packet station, showing that at all states of the tide, and in any weather, vessels of large tonnage could come in with safety, and save at least a day as compared with Liverpool.

The Taff Vale Railway receipts for the last six months show an increase of of 10·4 per cent. over those of the corresponding period of 1887.

The shipments of Patent Fuel for the whole of 1888 were as follows:—Cardiff, 193,644 tons; Newport, 59,832 tons; Swansea, 257,227 tons; making an aggregate of 510,703 tons.

The Bute Shipbuilding and Engineering Co. (Limited), Cardiff, recently contracted for the erection of two steamers, one for Messrs. Morel Brothers & Co., and the other for a London firm. The first steamer will have a carrying capacity of 2,700 tons, and is now being pushed forward with rapidity, while the second vessel will carry close upon 4,000 tons. Both vessels are to be built of steel, constructed by the Dowlais Iron Co.

A deputation, representing mercantile and shipping associations of Bristol, Cardiff, and Newport, recently waited on the Swansea Chamber of Commerce with the view of soliciting its co-operation in a movement initiated for the provision of a harbour of refuge and naval and military station at Lundy, for the protection of life and property in the Bristol Channel. The deputation explained the defenceless position of the Channel, and the ease with which an armed cruiser could enter it and destroy all the docks, through which a fourth of the trade of the kingdom passes. The great use of a harbour of refuge was also pointed out. The Swansea Chamber promised co-operation if the Government were allowed to select the site.

It is satisfactory to report that all trades are still showing, at the close of the month, that state of activity which set in with such fair promise with the new year. Quotations all round are decidedly high, and there appears no prospect of relapse, in fact, the signs are the other way.

Present prices of best steam coal are 13s. 6d. to 13s. 9d., and as for small, it is scarce at 8s. 3d., and every prospect of another advance.

BELFAST TRADE NOTES.

OWING to the launches which have taken place here since the first of the month, trade in the Engineering department is exceptionally brisk. Messrs. Harland & Wolff have now the s.s. *Teutonic* and the s.s. *Runic* in hands fitting out, and thereby employment is given to a great number of hands. The *Teutonic*, whose performances will be anxiously watched by the shipping world, will be ready for the summer trade across the Atlantic, and should she prove as great an advance upon the present White Star Liners as they were in their time, some surprises will be in store. As a full description of her is given elsewhere, we need not say any more here. Her sister-ship, the *Majestic*, is now in a very advanced state. In addition to nine large steamers now in hand, employing some 5,000 hands, there are several steamers undergoing repair, also the fine steam yacht *Jason*, belonging to Jas. T. Bilby, Esq., which is undergoing extensive alterations to her boilers and engines.

Messrs. McIlwaine & Maccoll (Limited), have almost ready for sea the new steamer *Topic*, launched by them this month, and have also under repairs the s.s. *Alps* and s.s. *City of Dortmund*.

Messrs. Workman, Clark & Co. (Limited), the Belfast Shipyard, have some large steamers almost ready for launching; these will receive their machinery on the other side of the Channel.

Owing to the increase of the shipping trade of Belfast, and the size of vessels trading here, the Belfast Harbour Commissioners took steps to provide extra dry dock accommodation, and the splendid graving dock, named the Alexandra Graving Dock, the first sod of which was cut by the Princess of Wales in April, 1885, is now almost completed, the caissons built by Messrs. Workman, Clark & Co. (Limited), having been tried in their places. Each of them are fitted with engines and pumps, and can be floated out of their places in a very short time.

At the new graving dock on the quay outside it, a 100-ton steam derrick crane is about to be erected, and already the contractors, Messrs. Taylor, Birkenhead, are delivering the parts, and in a short time it will be ready for work.

The Harbour Commissioners are also about to construct a new dock between the present Dufferin Dock and the Albert Quay, owing to the want of accommodation for the increased shipping trade.

LEITH NOTES.

ALL the yards here continue brisk, and night and day shifts are employed in some cases. Of new work place during the month, Messrs. Ramage & Ferguson have received an order for two steamers of upwards of 1,200 tons register for Messrs. James Currie & Company's Continental trade. One is to have accommodation for passengers, and the other is a cargo-boat. Several repairing orders also have been placed locally. On the 18th inst. Messrs. Hawthorns & Co. launched from their yard a small steel screw tug named the *Condor*, built to the order of the Loto Company, of Chili. She is to be fitted with engines to indicate 45 H.P. The above firm have made a small addition to their shipbuilding plant in the shape of a new heating furnace.

Messrs. King, Brown & Co., Rosebank, are busy with the electric installation for the magnificent new steamer *City of Paris*, at present lying on the Clyde. It will be identical with that supplied by them to the s.s. *City of New York*.

The steamer *Resolute*, of Yarmouth, 72 tons register, has been purchased by the London and Edinburgh Shipping Company. She is to be employed carrying gunpowder between Leith and London.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES.—English.

Quickstep.—On December 17th, Messrs. John Priestman & Co., of Castletown Yard, Southwick, Sunderland, launched a steel screw steamer for local owners. The dimensions are:—218 ft. over all, 31 ft. broad, and 16·4 ft. depth moulded. The vessel has a long raised quarter-deck, bridge house, and topgallant forecastle, and will be fitted with tri-compound engines with cylinders 17, 28, and 46 in., and stroke 30 in., by the North-Eastern Marine Engineering Company (Limited). The vessel is fitted with three steam winches by Messrs. Welford Bros., and has Davis's steam steering gear amidships, Hastie's screw gear aft, and Emerson and Walker's patent windlass on the forecastle. The vessel received the name of the *Quickstep* from Mrs. John Priestman.

Clarissa Radcliffe.—On December 19th, at the Jarrow yard of Palmer's Company, a steel screw steamer was launched, of the following dimensions:—Length, 296 ft.; breadth, 40 ft.; depth, 23 ft. 2 in. She is built of steel to take highest class at Lloyd's, and is rigged as a two-masted schooner. She has a short sunk poop, containing accommodation for the captain and officers, and forward of this a long raised quarter-deck, extending to the aft end of the bridge. A long bridge amidships extending over machinery space to foremast, contains accommodation for engineers at the aft end, and crew and firemen at the fore end, and there is an open topgallant forecastle. A cellular double bottom for water ballast is fitted all fore and aft. The vessel is fitted with Muir & Caldwell's steam steering gear amidships, and screw gear aft, also direct steam windlass. She will load about 3,800 tons d.w. The steamer was named *Clarissa Radcliffe* by Miss Thomas, of Cardiff, daughter of Mr. Thomas, of Messrs. E. Thomas, Radcliffe & Co., for whom the vessel has been built.

Blakemoor.—On December 19th, at the shipbuilding yard of Messrs. John Readhead & Sons, West Dock, South Shields, a steel screw steamer was launched, named the *Blakemoor*, which has been built to the order of Messrs. Walter Runciman & Co., of South Shields. The dimensions of the vessel are as follows:—Length, 259 ft.; breadth, 36 ft.; depth of hold, 19 ft. She has been built under special survey to class 100 A 1 at Lloyd's, and is of the improved well-deck type, having a long, raised quarter-deck, bridge amidships, and top-gallant forecastle. The vessel has been designed and fitted to comply with the Grain Cargoes Act, and will have a deadweight capacity of 2,650 tons. The engines are of the triple-expansion principle, having cylinders of 20½ in., 33½ in., and 55 in., with a stroke of 36 in. Steam will be supplied from two large steel boilers, working at a pressure of 160 lb. The engines and boilers have also been built by Messrs. Readhead & Sons. The vessel was named by Mrs. Runciman, wife of the managing owner.

Paddle-Wheel Ferry Boat.—On December 20th the second of the two paddle-wheel ferry boats for North Woolwich was successfully launched from the yard of Messrs. R. & H. Green, Blackwall. The vessel is built for the Metropolitan Board of Works for the new free ferry now in course of construction at Woolwich. The hull is of steel with longitudinal bulkheads, as well as water-tight transverse bulkheads, and is double-ended. The engines and boiler are by Messrs. G. Penn & Sons, of Greenwich.

Darial.—On December 26th the third ship built by Messrs. Armstrong, Mitchell & Co., from the designs of their director, Mr. Henry F. Swan, for the Kerosene Company, of London, was launched at Walker. She is very similar to the ships lately delivered for the same firm, and is 310 ft. long, 40 ft. 3 in. beam, 29 ft. 6 in. moulded depth, and will lift 4,000 tons. She is constructed for the carriage of petroleum in bulk, and is fitted with several special arrangements for her intended trade. Electric light is fitted throughout, steam steering-gear placed aft and controlled by valve rods from the bridge amidships, direct steam windlass, winches, and powerful duplicate pumps for quick discharge of cargo. She has engines 23 in., 37 in., and 60 in., supplied with steam of 150 lb. pressure from boilers of large size, with forced draft on the closed ashpit system. She has been inspected during construction by the owners, superintending engineers, Messrs. Flannery, Baggallay & Johnson, of London and Liverpool, and upon completion will be put upon the direct line from Batoum. Her name, *Darial*, was gracefully given her, as she left the ways, by Mrs. Morris, wife of Captain F. Morris, who will command the vessel.

Cycle.—On December 31st, Messrs. Joseph L. Thompson & Sons successfully launched, from their North Sands shipbuilding yard, a steel steamer of 3,100 tons deadweight, built to the order of Messrs. R. Nicholson & Sons, of Liverpool. This vessel is of the raised quarter-deck type, and built on the improved system of web frame construction. The bridge deck extends the full length of the vessel from amidships, giving this type of vessel ample 'tween deck accommodation. Six steel water-tight bulkheads are fitted, and the water ballast tanks extend fore and aft, on the cellular bottom principle. The engines have been built by Mr. John Dickinson, of Palmer's Hill Engine Works, and are of the triple-expansion type, of about 900 indicated horse-power, supplied with steam from two steel boilers, each having a working pressure of 150 lb. to the square inch. The deck machinery consists of direct steam windlass, four horizontal steam winches, and steam steering gear, and patent screw-gear aft. The vessel, on leaving the stocks, was named the *Cycle* by Miss Mary Thompson, daughter of Mr. Robert Thompson, Fulwell West House.

Alheria.—On December 31st, Messrs. Raylton, Dixon & Co., launched from their Cleveland Dockyard, Middlesbro'-on-Tees, a steel screw steamer, which has been built to the order of Mr. Christopher Furness, West Hartlepool, for Mr. R. H. Penney of Brighton. Her dimensions are as follows:—Length, 304ft. 3in.; breadth, 38ft.; depth moulded, 22ft. 10in., with a carrying capacity of 3,600 tons. On leaving the ways she was christened the *Alheria* by Miss Catherine S. Penney, of Darlington.

Leven and Karoon.—On December 31st the shipbuilding programme for 1888, at Messrs. William Gray & Co.'s yard, was brought to a successful termination by the launch of two large steamers, the *Leven* and the *Karoon*. The former, built at the Central yard, to the order of Messrs. R. Ropner & Co., is a vessel capable of carrying 3,500 tons, the dimensions being 290ft. by 38ft. by 20ft. 3ins. She is fitted with long bridge, and constructed on the web frame principle, and, being supplied with all the latest improvements, should prove a profitable addition to Messrs. R. Ropner & Co.'s. large fleet of steamers, nearly all of which have been built by William Gray & Co. The *Karoon* has been built to the order of Messrs. Thomas Appleby & Co. She is of similar design to the *Leven*, and is intended to carry a deadweight of 3,100 tons, her dimensions being 275ft. by 37ft. 2in. by 20ft. This is the tenth vessel built by William Gray & Co. for Messrs. Thomas Appleby & Co. Miss Baines, of West Hartlepool, officiated at the christening of the *Leven*, and Mrs. Blake, wife of Captain Blake, acted as sponsor for the *Karoon*.

Racer.—On January 1st a new schooner was launched from the shipbuilding yard of Mr. Anderson, Kingston-on-Spey. She is intended for the Baltic trade, and has been purchased by Messrs. Smith Coull, Lossiemouth. The vessel was named *Racer* by Miss Smith, daughter of one of the owners.

Ricardo.—On January 1st there was launched, from the shipbuilding yard of Messrs. W. Pickersgill & Sons, Southwick, Sunderland, a steel screw steamer of the following dimensions:—Length, 290 feet; breadth, 34 feet; depth, 16 feet. Built to the order of Messrs. Richard W. Jones & Co., of Newport (Mon.). This is the third vessel constructed by the builders for the same owners, and has raised quarter-deck to bridge and topgallant-mast forecastle, and built to the highest class at Lloyd's. The officers are berthed in the cabin aft, engineers amidships, and the crew in the top-gallant forecastle. She has three steam winches by Messrs. Clarke, Chapman & Parsons, of Gateshead; Davis's steam steering gear, and Harfield & Co.'s patent windlass. Her engines and boiler will be supplied and fitted by Mr. George Clark, of Southwick, on the triple-expansion principle. On leaving the ways she was named the *Ricardo* by Mrs. Charles Pickersgill.

John Sanderson.—On January 2nd, from the yard of Messrs. Short Brothers, Pallion, Sunderland, was launched a vessel 335 ft. long, 42 ft. broad, 28 ft. 9 in. deep; she will carry about 4,600 tons all told, on 23½ ft. draught, and will have triple-expansion engines of 300 H.P. by Mr. John Dickinson. She is replete with all the latest improvements in

construction and outfit. As she left the ways she was named the *John Sanderson* by Mrs. Thomas Scott. The vessel is to be owned by Messrs. Taylor & Sanderson, of Sunderland, and is the sixteenth steamer built by the same firm for these gentlemen.

George Clarkson.—On January 2nd, Messrs. Thomas Turnbull & Son launched from their premises, Whitehall, Whitby, a steamer, constructed of steel, built to the order of Messrs. H. Baxter & Co., steamship owners, Whitby, and the ceremony of naming was performed by Miss Jane Gallilee, daughter of one of the partners. The vessel was named the *George Clarkson*, after a London gentlemen of that name, who is an extensive holder of shares in Whitby. The following are the dimensions and particulars of the new ship:—Length over all, 268 ft. 9 in.; length between perpendiculars, 258 ft.; breadth, 37 ft.; depth to top of floor plate, 18 ft. 1 in.; class 100 A 1 at Lloyd's; deadweight capacity, about 2,570 tons at 18 ft.; bridge, 112 ft.; with lodgings for officers and crew under it; raised quarter-deck, 60 ft. long; poop aft, 28 ft. in length; six water-tight bulkheads of steel; Emerson & Walker's patent windlass; four steam winches, two of 6-in. cylinders and two of 7-in.; Rodgers' steam steering gear; screw steering gear aft; companions and skylights of iron; schooner rig; engines by Blair & Co., direct acting, triple-expansion; diameter of cylinders, 20, 33 and 54 in.; stroke, 36 in.; nominal H.P., 140; two cylindrical tubular boilers of steel with Fox's patent corrugated furnaces; working pressure, 160 lb. The *George Clarkson* will be commanded by Mr. Kirby.

Southwark.—On January 2nd the first launch of the year on this river took place at the shipbuilding yard of Messrs. Schlesinger, Davis & Co., Wallsend-on-Tyne, when the s.s. *Southwark* was successfully consigned to her native element. The *Southwark* has been built to the order of Messrs. M. A. Kay & Sons, of London, for trading between here or Sunderland and London, and is designed to carry 800 tons coals on a very light draft. Her dimensions are as follows:—Length, 168 ft. between perpendiculars; breadth, 30 ft.; depth, moulded, 14 ft. She has a double bottom fore and aft on the cellular principle, which will enable the vessel to carry a large quantity of water, and take her northern passages without cargo, if necessary. The accommodation for captain and officers is amidships, under the bridge, whilst the engines are placed aft, alongside the engines, which are of the triple-expansion description, with cylinders 14 in., 23 in., and 39 in. in diameter, with a stroke of 27 in. These will be supplied with steam, at 160 lbs. pressure, by a large steel boiler. The contractors for the machinery are Messrs. Ernest Scott & Co., Close Works, Newcastle. Special arrangements have been made for rapid loading and discharging of cargo, the vessel being provided with powerful steam winches and gear, and abnormally large hatches to save trimming. On leaving the ways the steamer was gracefully christened by Mrs. Hopper, wife of the owner's agent in Sunderland. She is fitted with Emerson, Walker & Co.'s patent steam windlass.

Peace.—On January 3rd a numerous party of ladies and gentlemen visited the works of the Blyth Shipbuilding Co., Limited, at Blyth, to witness the launch of a large steel screw steamer, built for Messrs. H. Clapham & Co., of Newcastle-on-Tyne, on behalf of the Clapham Steamship Co. The vessel, which will carry about 2,500 tons, is built of steel as is of such strength as to obtain Lloyd's highest class. She is constructed on the cellular bottom and web frame principle, with raised quarter-deck, and has a long bridge extending from the engine space to foremast, and a topgallant forecastle. There are very large cargo hatches, with four powerful steam winches, by Clarke, Chapman, Parsons & Co.; Donkin & Nichol's Steam Steering gear. The donkey boiler is by the Tyne Boiler Works Co., and the powerful windlass by Emmerson, Walker & Thompson Bros. The vessel has been built to the requirements of Board of Trade for carrying grain in bulk. The accommodation for captain and officers is at the fore part, and for engineers at the after part of engine space, the crew being berthed in the forecastle. The engines are being made by Messrs. Ernest Scott & Co., Newcastle-on-Tyne. As the vessel left the ways she was gracefully christened the *Peace* by Miss Nora Macarthy, youngest daughter of the managing owner.

Joseph John.—On January 4th this vessel was successfully launched from the yard of Messrs. W. Doxford & Son, Pallion. She has been built to the order of Otto Jaffe, Esq., of Belfast, for the general trades, and is entirely of steel, built to Lloyd's 100 A 1 Class. The principal dimensions are: Length between perpendiculars, 280 ft., breadth, 38 ft. 3 in., depth moulded 21 ft., with cellular bottom fore and aft. The engines are triple expansion, three cranks with all Messrs. Doxford's latest improvements, the cylinders being 21 in., 35 in., and 57 in. respectively, and the stroke 39 in.; they are supplied with high pressure steam from exceptionally large boilers. She is fitted with bow, McLachlan's patent steam steering gear, and Hostie's screw gear aft, and four winches by Messrs. Welford Bros. of Gallion, with all the most recent improvements for cargo purposes. The cabins are most tastefully constructed in hardwood in the bridge, and afford most comfortable quarters for captain and officers, engineers being berthed in after end of bridge, and crew in forecastle. The vessel is a duplicate of the s.s. *Daniel*, recently built for Otto Jaffe, Esq., by Messrs. W. Doxford & Sons. She is fitted with Emerson, Walker & Co.'s patent direct steam windlass.

Cairntoul.—On January 16th there was launched, from the Howdon yard of Palmer's Shipbuilding and Iron Company (Limited), a steel screw steamer, of which the following are the dimensions:—Length, 260 ft.; breadth, 37 ft.; depth, 19 ft. 2 in.; depth of hold, 18 ft. The vessel, which will be rigged as a two-masted schooner, has steel main and quarter decks, iron bridge and forecastle decks. She will have a long raised quarter-deck to the after end of the bridge. In a sunk poop aft the captain and officers will be located; whilst a long bridge amidships, extending over the engine and boiler space to the foremast, will provide accommodation at the after end for the engineers, and at the fore end for the crew and firemen. She will have an open topgallant forecastle, four water-tight steel bulkheads, complete set of shifting boards, and water ballast in cellular bottom, all fore and aft. The steamer will be fitted with Messrs. Clarke, Chapman, Parsons & Co.'s patent windlass; Messrs. Donkin and Nicol's steam-steering gear amidships and screw gear aft. The vessel, which has been built to the order of Messrs. R. and D. Cairns, of Leith, is a sister ship to the *Cairnryan*, launched from this yard last year for the same firm. On leaving the ways she was named the *Cairntoul* by Mrs. Inglis, wife of Dr. Inglis, of Jarrow.

Sikh.—On January 16th Messrs. Wigham Richardson & Co. launched from their Neptune Works, Newcastle-on-Tyne, a steel cargo and passenger steamer, intended for the China and Japan trade, which they have built for the Mogul Steamship Company (Limited), of London. The vessel was named the *Sikh* by Miss Christie, eldest daughter of the senior partner in the builders' firm. She dimensions of the hull are 345 ft. long, 40 ft. beam, and 25 ft. 9 in. depth of hold, and she will be classed 100 A 1 steel three-decked at Lloyd's. She is to be fitted with steam windlass, steam steering gear, steam winches, and every other modern appliance for the rapid loading and discharging of cargo, and will be supplied with the builders' own type (Tweedy's patent) triple-expansion engines.

The Presidente de Para.—On January 18th this vessel was launched at Seacombe, by Messrs. J. F. Waddington & Co., shipbuilders and engineers, the principal dimensions being:—Length, 170 ft.; breadth, 25 ft.; depth to main deck, 5 ft. 6 in.; depth to upper deck, 12 ft. 6 in. This vessel, which has been specially designed, built, and engined by the above firm, for foreign service, is one of the largest stern-wheel steamers ever constructed in this country; she has three decks, the main deck being of steel, upon which are placed two large loco boilers to work at 125 lb. press, and the engines placed at stern being compound jet-condensing, of sufficient power to drive the vessel at a speed of 11 knots per hour. Ample space is also provided on this deck for carrying cattle and light cargo in addition to the two cargo holds below. On the upper deck which extends the full width and length of the vessel, accommodation is provided for first-class passengers. Deckhouses containing state-rooms, ladies' cabin, bath-rooms, &c., also offices, rooms, and pilot-house forward being fitted on this deck. Special attention has been given to ventilation throughout, a light wood awning deck being fitted above. This vessel is fitted with two steam winches, steam windlass, and steam capstan, being rigged as a three-masted schooner, and will sail out shortly to her destination on her own bottom. Messrs. J. F. Waddington & Co. will shortly launch a steel twin-screw passenger and cargo steamer for same owners and trade, and have, in addition to other vessels, a stern-wheel steamer building which is guaranteed not to draw over 1 ft. 3 in. of water.

Ataka.—On January 19th Messrs. Ropner & Son launched a steel steamer from their North Shore yard at Stockton. Her dimensions are:—Length over all 384 ft. 3 in., breadth 42 ft. 3 in., and depth 29 ft. Her gross register will be over 3,700 tons, and her deadweight carrying capacity 6,500 tons. She will be engined by Messrs. Blair & Co. (Limited), the nominal H.P. being 400. This is the 14th steamer launched from this yard for the same owners, and as she left the ways was christened the *Ataka* by Miss Nellie Newell, daughter of the owner's captain superintendent.

Sir Francis Head.—On January 19th Messrs. Head and Barnard successfully launched, from their Groves shipbuilding yard at Hull, the second of the four submarine vessels building to the order of Her Majesty's War Office. As the vessel left the ways she was christened the *Sir Francis Head* by Miss Gertrude Allison. Immediately after the launch the slip was prepared to receive another keel. The four vessels that Messrs. Head & Barnard are building for Her Majesty's War Office are of the twin-screw type, the engines being supplied by Messrs. Amos & Smith, Hull.

LAUNCHES.—Scotch.

Banks Peninsula.—On December 22nd the Grangemouth Dockyard Company launched a twin-screw steamer of the following dimensions:—125 ft. by 20 ft. by 10 ft. 6 in., and classed 100 A 1 at Lloyd's. The vessel has been built to the order of the Akaroa and Peninsula Steam Navigation Company, of Lyttelton, New Zealand, and is intended for their passenger trade. She will be fitted up with all the latest improvements, and engines will be supplied by Messrs. Hutson and Corbett, Kelvinhaugh, two sets to indicate 450-horse power, and will also be supplied with Wrench's patent propellers, which have been found to give good results. A high rate of speed is expected. As the vessel left the ways she was named the *Banks Peninsula* by Miss Hay, of Lyttelton, New Zealand.

Dredger.—On December 31st Messrs. Fleming & Ferguson, Shipbuilders and Engineers, Paisley, launched the third of a fleet of dredgers, which they have constructed for the Corporation of Preston, to be used in the deepening of the River Ribble. These dredgers are 170 ft. long by 40 ft. beam, and are said to be the most powerful dredgers afloat in this country. The machinery and gearing throughout is made of crucible cast steel. Each bucket has a capacity of 23 cwt., and the machine is capable of raising 1,000 tons per hour from a depth of 35 ft.

Clunie.—On January 5th an iron screw steamer of the following dimensions:—Length, 120 ft.; breadth, 20 ft.; depth of hold, 10 ft.; gross tonnage, 250 tons—was launched from the Shipbuilding yard of Messrs. John Duthie & Sons, Dundee. The steamer, which was named the *Clunie*, is to be supplied with compound-surface condensing engines of 45 H.P., and is expected to attain a speed of nine knots per hour. She is to be engaged in the coasting trade, and has been built to the order of Mr. W. Todd Moffatt, Aberdeen.

Otter.—On January 14th there was launched from the yard of Messrs. W. Simons & Co., Renfrew, a patent stern well-hopper dredger, named *Otter*, which has been constructed to the order of Mr. Walter Peace, agent for the Natal Harbour Board. The vessel was launched complete, with machinery on board. The naming ceremony was gracefully performed by Mrs. William Brown, of Renfrew. The *Otter* is of the following dimensions:—Length, 170 ft.; breadth, 32 ft.; depth, 14 ft. In the forward part of the dredger are fitted two pairs of independent compound surface condensing engines, of 500 indicated H.P., each pair driving its own line of propeller shafting, while the dredging operations can be carried on by either pair of engines, and each of which will be capable of raising 400 tons of ordinary material per hour. Steam is supplied by two steam boilers of 100 lb. pressure. When the boilers are cold, and when raising steam in them, separate donkey boilers and engines are provided for circulating the water—this is a very necessary provision against their unequal expansion and contraction, so ruinous to boilers. The engine-room, which is very spacious, is provided with Blackman's patent ventilating fans, and has also telegraphic communication between the bridge and the dredging gear. Patent steering gear is provided. An important improvement has been developed by this firm in connection with the dredging gear—Brown's patent traversing gear—by which the bucket ladder can be moved forward or backward independent of the vessel, and thus be made to project through the stern of the vessel and cut its way into and through sandbanks where there would not ordinarily be sufficient water to float in. The point of difference between this and other dredgers is not in the application of the traversing gear, but in the stern being divided instead of the base for the projection of the bucket ladder, and in this manner having a solid instead of a divided bow, which is better able to withstand heavy seas. In the suspension of the bucket ladder another improvement has been effected by hanging the bucket ladder on a separate shaft from that which holds the top tumbler, so that the latter may be taken out without having to disconnect the lower tumbler. Spring buffers are fitted at the top bearings of the bucket ladder, so that when rising and falling in a swell when dredging the risk of breakage to the ladder shaft bearings is reduced to a minimum. The buckets have a capacity of about half-a-ton each, and are of somewhat different form, and a decided improvement upon those now in general use. Ripping claws are provided for the disintegration of hard material.

Beaver.—The builders have in a forward state of completion for the same owners the hopper dredger *Beaver*. This dredger, instead of a bucket ladder, will have two very powerful centrifugal sand pumps, which will raise about 1,200 tons of sand per hour. The above-described dredgers are constructed from the specifications of Mr. C. W. Methven, M. Inst. C.E., Resident Engineer to the Natal Harbour Board, and the practical inspection of them in this country has been in the hands of Mr. D. Macallister, C.E., assisted by Mr. John Stewart, M.E. The selection of the hopper dredger instead of the stationary dredger system as the most suitable for the port of Natal, has been the result of careful consideration. At this port the distance to place of deposit being short, and sometimes rough seas have to be encountered, the danger that there is in connection with towing barges, or loading them alongside ordinary dredgers, in a case like this is obviated. A great advantage it has is that, instead of the dredged material being shot into barges for conveyance to the place of deposit, the spoil is dropped into hoppers within the dredger's own hull, and when these hoppers are full the moorings of the dredger are cast off, and it steams to the place of deposit, where it empties its hoppers and then returns to the site of dredging, and commences to load again exactly where it left off. Another point in favour of this improved system over the old system is that, when the material has to be dredged is of varying quantity and hardness, a sufficient number of hopper barges must be provided to keep the ordinary dredgers fully employed while dredging in soft material, and, consequently, when hard material is being lifted—the quantity naturally being less—some of the barges and their crews must remain idle.

Carr Rock.—On January 15th a fine steel sailing ship, of about 1,700 tons and 100 A 1 class, built by Messrs. Alex. Stephen & Sons to the order of Messrs. James Cornfoot & Co., Glasgow, was launched at Linthouse, and named the *Carr Rock* by Miss Bryson, Kirkcaldy. The *Carr Rock* has poop, deck houses, and topgallant forecastle, and is fitted with all the best modern appliances. She has a beautiful appearance, and will form an excellent addition to the "Rock Line" of sailing ships. She is to load for Sydney, and is to be commanded by Captain Cavell.

Dean.—On January 17th the steamer *Dean*, built by Messrs. Gourlay Brothers & Company, to the order of Messrs. George Armitstead & Company, was launched from Camperdown Shipyard, Dundee, the christening ceremony being performed by Miss White, Spring Grove. The new vessel's measurements are:—Length, 260 ft.; breadth, 36 ft.; depth of hold, moulded, 19 ft. It is expected that she will carry about 2,200 tons, and every appliance for the rapid handling of cargo has been introduced. After the launch the vessel was lowered into Victoria Dock to get on board her engines, which will be about 180 nominal H.P. Captain Charles Taggart has been appointed to the command of the *Dean*, which is chiefly to be employed in the Baltic and Mediterranean trades.

Scottish Maid.—On January 19th there was launched from the shipbuilding yard of Messrs. John Scott & Co., Kinghorn, an iron screw trawler named the *Scottish Maid*, built to the order of Messrs. Robert Brown & Co., Aberdeen. The following are the dimensions:—Length, 100 ft.; breadth, 20 ft.;

depth, 10½ ft. She is fitted up with vertical direct-acting compound engines of such a kind as to render her one of the most powerful trawlers afloat, and is expected to attain a speed of 15 knots an hour. She was launched with steam up, and sailed to Burntisland without the aid of a tug.

Orient.—On January 21st Messrs. C. Connell & Co. launched, from their Shipbuilding yard at Scotstoun, a finely-modelled steel sailing ship of 1,650 tons register, which they had built to the highest class in Lloyd's registry. As she left the ways she was named *Orient*, in the customary manner, by Mrs. Knebb, wife of the commander of the vessel, and was immediately towed to Finnieston crane to be masted. The *Orient* is for Hamburg owners, and will be engaged in general trade.

Munchen.—On January 23rd the Fairfield Shipbuilding and Engineering Company (Limited), launched from their yard a steel screw steamer, of about 5,000 tons, for the Norddeutscher Lloyd of Bremen. As the vessel left the ways she was named the *Munchen* by Miss Maclean. Her principal dimensions are: —Length over all, 405 ft.; breadth, 46 ft. 6 in.; depth, 33 ft. The *Munchen*, like her sister ship the *Dresden*, launched some six weeks previously, has been constructed in accordance with the newest regulations of the Germanischer Lloyd under their special survey, and will be classed in the highest grade of that society. She also conforms in every respect to the Board of Trade regulations, and to the latest requirements of the United States. She is built throughout of the best tough ductile Martin steel, and has two watertight steel decks, all fore and aft, poop bridge-house, and topgallant forecastle. The weather and upper decks are of teak, and the deckhouses are of steel and teak. When complete the vessel will have accommodation for about 40 first-class, 16 second-class, and 2,000 third-class passengers, besides ample accommodation for the officers and crew. The *Munchen* is lighted throughout by electricity, for which purpose she has two distinct engines and duplicate dynamos, each furnishing power for about 300 incandescent lights. Provision against fire has been made by suitable subdivision of the ship, and by the use of steam injectors and independent water service from powerful hand and steam pumps. In the unlikely event of disaster she is amply provided with 10 large steel lifeboats, besides collapsible boats. The *Munchen* is schooner-rigged, having two pole masts of steel, with yards on the foremast. She will be fitted with steam capstan windlass, warping capstan, steam winches, and all the latest improvements for working cargo and safety of passengers. The engines for the *Munchen* are of the inverted triple-expansion type, with cylinders of 30, 50, and 80 in. diameter, the stroke of piston being 4 ft. 6 in. The crank-shaft is built, and, like the propeller shaft, is made of Vickers, Sons & Co.'s steel. The tunnel shafts are of Siemens-Martin steel, and were supplied by Messrs. John Brown & Co., Sheffield. The engines are fitted with all the latest improvements for economising fuel, including a feed-water heater, a fresh water producer for the boilers, &c. The propeller boss and blades are of cast steel, the latter being coated at the back by Johnston's process. Steam is supplied from two double-ended boilers and one single-ended auxiliary boiler, made of steel plates throughout. The furnaces, 15 in number, are also of steel, and corrugated. The boilers have been constructed in accordance with the British Board of Trade and Germanischer Lloyd rules for a working pressure of 150 lb. per square inch.

LAUNCHES.—Irish.

Runic.—On January 1st a new cargo-carrying steamer, built to the order of the White Star Company, was launched from the shipbuilding yard of Messrs. Harland & Wolff, Queen's Island, Belfast. The vessel, which was named the *Runic*, is a sister ship to the *Cunic*, which was launched from the same place on October 10th last. The *Runic* has been built to the order of Messrs. Ismay, Imrie & Co., White Star Line, Liverpool, is over 4,000 tons register, and has been fitted with triple-expansion engines, also constructed by Messrs. Harland and Wolff, having 2,400 indicated H.P. The *Runic* will be completely fitted out for sea by the Queen's Island firm.

Topic.—On January 1st there was launched from the yard of MacIlwain and MacColl, Belfast, the iron screw steamer, *Topic*, built to the order of Mr. W. A. Grainger. The vessel is 173 ft. long, 26 ft. beam, and 13 ft. deep. She has been specially designed for the coasting trade.

LAUNCHES.—German.

Diana.—On December 22nd there was launched s.s. *Diana*, stock number 101, a fine steel passenger steamer, built by the the Flensburg Shipbuilding Co., for the Hamburg Pacific Line in Hamburg, the managing director of which is Mr. A. Kirsten. Her dimensions are: 296ft. by 36ft. by 27ft. 6in., and will have engines of 1,300 h.p., and classed 1st div., Veritas.

Holtenau.—On January 15th there was launched at Kiel, from the Germania-Werft, a powerful steam dredger, built for the North Sea and Baltic Canal. The dredger is built entirely of German steel, and is designed to dredge 400 tons per hour from a maximum depth of 42 ft. Her dimensions are:—Length, 120 ft.; breadth, 24 ft. 3 in.; depth, 11 ft. 6 in. The engines, which are constructed at the same company's engine works at Tegel, are of the triple-expansion type, and will indicate 150 H.P. They are so arranged that they can act directly on the propeller shaft, and will drive the dredger at a rate of about 5 knots. The dredger was christened *Holtenau*, which is the name of the station on which she will be placed. A second dredger, of the same dimensions, will be launched in about two months' time.

LAUNCH.—Swedish.

Rio.—On December 22nd a new iron steamer was launched from the Brodin shipbuilding firm at Gefle, Sweden. She has been christened the *Rio*. Her length is 180 ft., and she is 27 ft. broad and 11 ft. deep in the hold.

TRIAL TRIPS.

Aglaia.—On November 27th the steel passenger steamer, *Aglaia*, built for the "Deutsche Dampfschiffs Rhederei zu Hamburg," by the Flensburg Shipbuilding Co., made her trial trip. She is classed to 100 A1 at Lloyd's, and 1st div. Veritas, 3rd rule, and built of German steel. Her dimensions are: 322 ft. by 39 ft. by 26 ft. 3 in. In a long poop aft is accommodation for 30 first class passengers. Saloon fitted in a highly elegant style, on the promenade deck is fitted, in a house of teak, a very luxurious ladies'-saloon. All berths for passengers are supplied with very comfortable beds and sofas, fold-up lavatories, &c. The ship is lighted with electric light from Siemens and Halshe, in Berlin. The engines, built on the triple expansion principle, have a power of 1,600 I.H.P. On the trial trip everything worked to entire satisfaction, an average speed of 13½ knots was attained.

Gaw-Quan-Sia.—The fine passenger steamer *Valencia*, now called the *Gaw-Quan-Sia*, and formerly the *Walmer Castle*, of the Donald Currie Castle Line, has been, for some months past, at West Hartlepool for the purpose of having her old compound engines and four boilers entirely removed and replaced by a set of the Central Marine Engineering Co.'s triple-expansion engines of 21½ in., 35 in., and 58 in. diameter, by 39 in. stroke, and steel boilers, carrying 160 lbs. working pressure, and including one of their special make of propellers. After serving for several years in the Donald Currie line in the China and Cape trades, she was purchased by the Marquis de Campo, and ran with the Spanish mails across the Atlantic. Early in last year she became the property of Messrs. Jno. Wood & Co., of West Hartlepool, who, with the shrewdness and foresight for which they are noted, immediately entered into the contract above-named for fitting the vessel with the most modern machinery, with the result that she has, before completion, been very advantageously sold to a wealthy firm of Chinese shipowners, who have given her the euphonious name at the head of this paragraph, which we are told means, in plain English, "Good luck." There has, perhaps, been no previous case of conversion from compound to triple-expansion in which the advantages of so doing were so plainly apparent to everyone; for the new machinery occupies a space fore and aft in the vessel as much as 28 feet shorter than that occupied by the old machinery, and the whole of this difference is available for carrying cargo; in the second place, whilst her consumption was formerly 22 to 24 tons per day, it will now be 13 to 14 tons. When the vessel was placed in Messrs. W. Gray & Co.'s dry dock, her beautiful form was the admiration of all who saw her; and it was the opinion of those who ought to know that she is the finest model that was ever seen in this port. A

guarantee had been given by Messrs. J. Wood & Co. to Messrs. Boustead & Co., of London, the agents acting for the Chinese firm, that she would make an average speed, on trial with the new machinery, of 10 knots per hour; but it was apparent, on examination of the vessel in dry dock, that a much higher speed than this would be attained. On Thursday, December 20th, she went on her trial trip, Mr. W. Dudgeon, of London, being present on behalf of Messrs. Boustead & Co., there being also on board Mr. Wotherspoon, Board of Trade Surveyor; Mr. Austin, Lloyd's Surveyor, Mr. Jno. Wood, Mr. C. Furness, Mr. J. Wilson, Mr. A. Livingston, Mr. R. Livingston, Mr. Craig, Mr. Guthe, Capt. Lund, and several other gentlemen interested in shipping matters—Mr. T. Mudd representing the Central Marine Engineering Co. A heavy mist hanging over the land prevented the "measured knot" posts being seen, and the speed was therefore tested by making several runs between fixed buoys, in the bay between Hartlepool and the mouth of the Tees, of known distance apart, when it was found that, with the engines opened fully out and making 86 revolutions per minute, a mean speed was attained of a little over 12½ knots per hour. The indicated horse-power developed being 1,104, which is 154 H.P. above the contract stipulation. Although this increased power was produced, an ample supply of steam was maintained throughout at full boiler pressure. There was a total absence of vibration, the engines running with perfect smoothness, and absolutely without water on any of the bearings, everything going to the complete satisfaction of all parties. There were expressions of satisfaction at the new lease of life and usefulness before this fine vessel, consequent upon her conversion. The conversion was carried out under the superintendence of Mr. H. A. B. Cole.

Andriana.—On December 13th the new steel screw-steamer *Andriana*, built and engined by Messrs. John Jones & Sons, the well known firm of Liverpool engineers and shipbuilders, to the order of A. Embiricos, Esq., of Braila, for the Danube trade, to the plans and specifications of Messrs. William Esplen & Son, had a most successful trial trip, attaining an average of 11 knots. Her gross registered tonnage is 1,823·34 and nett registered 1,174·26, and she will carry a deadweight of 2,600 tons, and is propelled by triple-expansion engines of the builders' special design, which developed 1,100 H.P. She has all the latest improvements for rapid loading and discharging, including four of Clarke, Chapman & Co.'s large winches, also steam and hand steering-gear, windlass, &c. The saloon, which is elegantly fitted up in the poop, has every modern convenience, including marble baths for shower, spray, and jet (hot and cold). The state-room accommodation is for 12 first-class passengers, and particular attention has been given to ensure perfect ventilation.

Flintshire.—On December 20th the screw steamer *Flintshire*, recently launched by the London and Glasgow Shipbuilding Company (Limited), for Messrs. Jenkins & Co., London, went down the firth for her official trial trip. The *Flintshire* is the eleventh steamer constructed by the London and Glasgow Engineering and Iron Shipbuilding Company (Limited), for the Shire Line of steamers belonging to Messrs. Jenkins & Co., of London, trading between London and Japan. Her dimensions are:—Length, 344 ft.; breadth of beam, 40 ft.; and depth of hold, 26 ft. 6 in. She has a deadweight carrying capacity of 4,200 tons, with a gross of 2,900 tons. There is first-class passenger accommodation provided in the poop for 26 people, and accommodation for a limited number of second-class passengers under the promenade deck. The engines are of the triple-expansion type, also supplied by the builders, and on the trial indicated 2,700 H.P. The boilers, of which there are two, are built throughout of mild steel to sustain a working pressure of 155 lb. per square inch, and these, as well as the machinery and ship, have been constructed under special survey of Board of Trade, and to the 100 A 1 class at Lloyd's. The most recent improvements which experience has shown to be advantageous in the handling of the ship and the loading and discharging of cargo have been introduced, such as Napier's patent half-screw gear, and windlass and capstan, Muir & Campbell's patent steam steering gear, and Clarke, Chapman, & Co.'s steam winches. The vessel has also complete installation of electric light throughout the ship by the last-named firm, and is especially fitted up in conjunction with the other appliances on board for the rapid loading and discharging of cargo. The steamer is also fitted up by Messrs. D. Green & Co.'s ventilating system all through the holds, and is especially adapted for the monsoon season. On the upward run the speed of 13 1-10th knots per hour was attained.

Hafnia.—On December 20th the new steamer *Hafnia*, built by the Elsinore Iron Shipbuilding Company, Elsinore, Denmark, and belonging to the Danish Steamer Company, Kjöbenhavn, had a most satisfactory trial trip. The *Hafnia* is built entirely of steel. Her length is 260 ft., breadth 36 ft., and depth in the hold 18 ft. The engine is on the triple-expansion principle, and at the trial 700 H.P. were indicated, the consumption of coal being 1.3 lb. per H.P. The engine worked remarkably well, and both speed and consumption of fuel were considerably more favourable than the contract stipulated. The *Hafnia* loads about 2,350 tons, and the boilers work with 150 lb. pressure.

Empress.—On December 28th a new saloon paddle-steamer, named the *Empress*, and launched recently by Messrs. Napier, Shanks & Bell, Yoker, for the Lochlomond Steamboat Company, had her trial trip on the Gareloch. The vessel is constructed of steel, and is of the following dimensions:—Length, 165 ft.; breadth, 20 ft.; depth, moulded, 6 ft. 2 in. The engines have been constructed by Messrs. Rowan, Glasgow, and on the trial gave every satisfaction, the speed being in excess of that guaranteed.

Clan Gordon.—On December 29th this steamer, one of Messrs. Cayzer, Irvine & Co.'s well-known Clan Line, which has just had her engines converted into triple-expansion form by Messrs. James Howden & Co., left Glasgow for the Cape of Good Hope and India, *via* Liverpool. The engines have cylinders 22 in., 34 in., and 59 in. diameter, by 42 in. stroke, and are supplied with steam from one single-ended boiler 15 ft. diameter, having three furnaces, each 3 ft. 7½ in. diameter, the aggregate fire-grate surface being 50 sq. ft. The boiler is fitted with Howden's well-known system of forced draught. As the steamer left Glasgow in the afternoon, it was dark on arrival at Grenock, and there was not opportunity for the usual trial runs to be made, but the forced draught was used for sufficient time to test the power before the steamer came to anchor, she having to adjust compasses before proceeding to Liverpool. Though no special effort in using the forced draught was made, the mean power of the sets of diagrams taken showed the very high result of 1,390 I.H.P. at 69 revolutions per minute, or 26 I.H.P per sq. feet of fire-grate. Mr. Cayzer was on board with the manager of the company, Mr. Gibb, Mr. Lyall, superintending engineer, and other gentlemen interested in marine engineering, and all expressed themselves highly satisfied with the remarkable results of the forced draught and the admirable working of the machinery generally.

Gulf of Martaban.—On December 29th the steamship *Gulf of Martaban*, a new vessel, 320 ft. by 40 ft. 3 in. by 23 ft., built by Messrs. R. & W. Hawthorn, Leslie & Co., to the order of Messrs. the Greenock Steamship Co., left the Tees under her own steam on her return journey to the Tyne, whither she went for completion. Her engines are of the triple-expansion type of 300 H.P. nominal, having cylinder 26 in., 42 in., and 69 in. by 48 in. stroke, and working at 150 lb. pressure of steam, built and fitted by Messrs. Blair & Co. (Limited), of Stockton-on-Tees. She has throughout a complete electric light installation of 100 lamps of 16 candle power each, including masthead, side, and portable deck lights by Mr. P. B. Blair. This vessel is the last of four being built by Messrs. Hawthorn, Leslie & Co., for Messrs. the Greenock Steamship Co., the machinery for all the vessels being supplied by Messrs. Blair & Co. She had a most successful run, making a speed of 13 knots against a head wind and sea.

Lady Brassey.—On January 1st the official trials of the *Lady Brassey* took place in Stokes Bay, the result being in every way satisfactory, the speed attained being over 12½ knots, which is considerably in excess of that contracted for. The machinery, which is of semi-torpedo boat type, worked very satisfactorily. The *Lady Brassey* has been built to the design and under the supervision of Mr. Charles Blayburn, M.I.N.A., of 150, Leadenhall Street, London, and Newcastle-on-Tyne; she is 160 ft. long and 24 ft. beam. The propelling machinery consists of two sets of engines of the three-cylinder continuous expansion type, the dimensions being as follows: High-pressure, 10 in.; intermediate, 16 in.; and low-pressure, 26 in., by 18 in. stroke, steam being supplied from an ordinary marine boiler at 160 lb. pressure. The coal consumption proved to be very creditable, being 1½ lb. per I.H.P. It may be

added that under more favourable conditions than those existing on the day of the trial, it is expected that the boat will attain a speed of 13 knots. The *Lady Brassey*, a vessel which was constructed by Messrs. Ernest Scott & Co., Close Works, Newcastle-on-Tyne, to the order of the Hastings and St. Leonard's Steamboat Company, has been selected by the Hon. Mr. Brassey, in conjunction with the Naval Volunteer Home Defence Association, to be used—when not engaged in excursion work—as a training-boat for marine volunteers, and will be armed with light but powerful guns.

Enrique Barrozo.—The screw steamer *Enrique Barrozo*, built by the Grangemouth Dockyard Company, and engined by Messrs. Hutson and Corbett, Glasgow, for Sen. Antonio Lanfranco, of Monte Video, went on her speed trials on the Forth last month. The vessel is 200 ft. long, 32 ft. broad, and has been designed to carry 630 tons on a draught of 10 ft. She has triple-compound engines, with cylinders 15 in., 24 in., and 40 in. in diameter respectively, with a piston-stroke of 30 in. Steam is supplied by one single-ended boiler, 12 ft. 6 in. in diameter and 10 ft. long, with three furnaces 3 ft. in diameter. The grate surface is 44 square ft., the total heating surface 1,100 square ft., and the condensing surface 700 square ft. On trial the speed attained was 9¾ knots, three-quarters of a knot over the guaranteed rate. The engines worked at 110 revolutions under a boiler pressure of 160 lb. to the square inch.

Maristow.—On January 3rd the trial trip of the new steel screw steamship *Maristow* took place on the Firth of Forth. The weather was propitious, although a strong breeze was blowing. Upon running a measured distance, a mean speed of 11¼ knots was shown on a double run, the engines working smoothly throughout. The *Maristow* is a screw steamer of the well-deck class, 263 ft. in length by 37 ft. beam, by 19.5 depth moulded. Her engines are of the triple-expansion type, with cylinders 19 in., 30 in., and 51 in. diameter, by 39 in. stroke, supplied with steam from two steel boilers, which work up to 160 lb. pressure. All the latest improvements have been introduced in this steamer, including steam winches, steam steering gear, &c., while her side lights are protected by lighthouses on each side of the forecastle. Mr. Bellamy, of Messrs. Bellamy & Co., Plymouth, the owners, was present at the trial, along with Mr. George Walker, of London, under whose superintendence the vessel and engines were built, and they, along with other gentlemen on board, expressed the highest satisfaction with the steamer's performances.

Adriana.—On January 3rd the steam yacht *Adriana*, built by Messrs. A. & J. Inglis, Pointhouse, left the Kelvin for a trial trip down the Clyde. Running the measured distance at Gareloch Head, it was found that the steamer, with 168 lb. boiler pressure, was doing from 11¼ to 11¾ knots—quite a satisfactory result for the builders, as well as Mr. Bubb, the owner. The machinery ran smoothly, no vibration being felt.

Arbib Brothers.—On January 10th the trial trip took place of the new s.s. *Arbib Brothers*, built for Messrs. E. & E. Arbib, London, by Messrs. C. S. Swan & Hunter, Wallsend. Dimensions:—330 ft.; over all, 40 ft. by 27 ft.; moulded, with engines, 24 in., 39 in. and 64 in., by 42 in. stroke and 160 lb. pressure; constructed by Messrs. Thomas Richardson & Sons, Hartlepool. She is classed 100 A 1 at Lloyd's, under special survey. The *Arbib Brothers* has considerable strength in addition to Lloyd's requirements, including complete double bottom. Iron upper deck, sheathed with wood, is fitted with special appliances for quick discharge of cargo and safety of the vessel, including five steam winches, with tubular donkey boiler, steam steering gear, direct steam windlass, &c., and has been constructed under the superintendence of Mr. James Casey, of London. With a cargo of over 4,200 d.w., the vessel, during trial runs on the measured mile, and afterwards on a run along the coast, steamed an average of 10¼ knots, which was half-a-knot in excess of the speed guaranteed.

Colchester.—On January 10th, the twin-screw steamship, *Colchester*, which the Messrs. Earle's Shipbuilding and Engineering Company (Limited), of Hull, have recently constructed for the Great Eastern Railway Company's passenger service between Harwich and Antwerp, was taken on her official trial trip. The vessel left Grimsby Roads at 7 a.m., the engines soon working up to full power. From Spurn light-ship the course was set for "Flambro" Head, on reaching which she was turned round and returned to Spurn, this distance (70 miles) being accomplished at an average speed of 15 knots per hour. The engines worked most satisfactorily throughout the day, and were never stopped or eased down from the time of starting to her arriving at the middle light-ship off Grimsby at 5 p.m., when some of the visitors were landed at that port. The ship then steamed to Hull, and cast anchor there at 6.35 p.m., and was taken into the Alexandra Dock at high water. The vessel will very shortly leave Hull for Harwich, where she will be handed over to the Great Eastern Railway Company, and at once be placed by them on the Continental service between Harwich and Antwerp, and will, no doubt, be as great a favourite with passengers as her sister ship, the *Cambridge*, and the other vessels built by Earle's Company for that service.

Despina G. Michalino.—On January 11th the screw steamer *Despina G. Michalino*, built by Messrs. R. Irvine & Co., to the order of Messrs. Michalino & Co., Constantinople, left West Hartlepool on her trial trip. Proceeding to Whitby, she attained a speed of 9½ knots, which, considering the heavy swell, was highly satisfactory. The engines, of the triple-expansion type, are by Messrs. Blair & Co. (Limited), Stockton, and are of the following dimensions:—Diameter of cylinders, 20, 33, and 54 in. respectively; 36 in. stroke; and a boiler pressure of 160 lb. The steamer's dead weight is 2,600 tons.

Dresden.—On January 12th the new screw steamer *Dresden*, built and engined by the Fairfield Shipbuilding & Engineering Company, Govan, for the North German Lloyd, went on her trial trip. She is a vessel of 5,000 tons, and her principal dimensions are:—Length over all, 405 ft.; breadth, 46 ft. 6 in.; depth, 33 ft. The *Dresden* is built throughout of the best tough ductile Martin steel, and has two watertight steel decks fore-and-aft. The *Dresden* is lighted throughout with electricity, for which purpose she has two separate engines and duplicate dynamos, each furnishing power of about 300 glow lamps. Provision has been made to guard against fire by suitable subdivision of the ship, and by steam injectors and independent water service by hand and steam pumps. The vessel is fitted with surface-condensing engines of the triple-expansion type, having three inverted cylinders, their diameters respectively being—high-pressure, 30 in.; medium-pressure, 50 in.; low-pressure, 80 in.; each adapted for a piston stroke of 54 in. The steam required for working the engines will be generated by two double-ended boilers and one single-ended auxiliary boiler, made of steel plates throughout. The furnaces, 15 in number, are also of steel, and are corrugated. The boilers have been constructed in accordance with the British Board of Trade and Germanischer Lloyd rules for a working pressure of 150 lb. per square in. The trial was satisfactory in every respect, the engines working with remarkable smoothness, while the vibration throughout the vessel was exceedingly slight. An average speed of 14 knots was attained, which is about a knot faster than guaranteed.

Oldham.—On January 15th the s.s. *Oldham*, built by Earle's Shipbuilding and Engineering Company (Limited), for the Manchester, Sheffield, and Lincolnshire Railway Company's service between Grimsby and the Continent, was taken on her official trial trip. This ship is 240 ft. long by 30 ft. beam, by 16 ft. depth of hold and is built of iron to Lloyd's highest class, with berth accommodation and spacious dining saloon for 40 first-class passengers in the poop. She had been brought down to her load draught for this trial, and as soon as the compasses had been adjusted by Mr. Olsen, of Grimsby, she was steamed round to Withernsea for the measured mile test, where, as a mean of four runs, she developed a speed of upwards of 12¼ knots, or more than three-fourths of a knot in excess of the contract, which was considered highly satisfactory. The vessel was then taken for a full-power run out to sea, and the average speed for two hours, as shown by the patent log, was also 12¼ knots.

Hessle.—On January 15th, s.s. *Hessle*, built by Messrs. Craig, Taylor & Company, of Stockton, for the Hudson Shipping Company, West Hartlepool, was taken on trial trip off the Tees. The dimensions of the vessel are 270 ft. by 37 ft. by 19 ft. 8 in. moulded, and she had on board over 2,600 tons, dead-weight, and steamed 9 knots on a small consumption of fuel. The machinery is by Messrs. Westgarth, English & Co., of Middlesbro'. The engines are 160 N.H.P., having cylinders 20 in., 33 in. and 54 in. by 36 in. stroke, with two large steel boilers, 160 lb. working pressure. Indicated H.P., 800. The

trial trip was in every way satisfactory to those on board, and the vessel sailed direct for Calcutta.

Rutherglen.—On January 19th the fine steel screw-steamer *Rutherglen*, built by Messrs. Palmers' Shipbuilding and Iron Co. (Limited), for the Caledonian Steamship Co. (Limited), went on her trial trip. The vessel is 312 ft. long, 40 ft. beam, and 27 ft. 6 in. deep, and will carry over 4,200 tons deadweight. She is fitted with all the best facilities for the rapid discharge of her large cargo, including four powerful winches and double donkey boilers, and is in every way most complete. The machinery, which is also by Messrs. Palmer, is on the triple-expansion type, with cylinders 23½ in., 38 in., and 62 in., with a stroke of 42 in., the boilers being of extra large size and fitted with Purvis' patent furnaces. The vessel made several runs on the measured mile, the mean speed obtained being 11¼ knots, the engines working very well at 93 revolutions. Among the gentlemen present at the trial were Mr. Joseph Boumphrey (chairman of the Caledonian Co.), Mr. M'Cullock (director), Mr. Crichton (secretary), and Mr. J. F. Flannery, of Messrs. Flannery & Blakiston, consulting engineers to the company, under whose superintendence the vessel has been built. After the usual toasts the owners expressed themselves highly satisfied with the vessel and the results of the trial. The vessel mmediately proceeded to her loading berth on the Tyne.

Zuria.—On January 19th the new steamer *Zuria*, which arrived at Greenock at the end of last year from Messrs. A. Macmillan & Son's yard, Dumbarton, to be supplied with triple-expansion engines and machinery by Messrs. Kincaid & Co. (Limited), went on her trial trip. The weather was stormy, notwithstanding which she averaged 11 knots per hour over the measured mile at Skelmorlie, which is about the guaranteed rate. Her owner (Senor Uraza, of Bilbao) was on board, and expressed himself highly pleased with the performances of his new vessel.

Ormea.—The twin-screw yacht *Ormea*, built to the order of Mr. William Hutcheson, Rothesay, of the Clyde Corinthian Yacht Club, from designs by Mr. R. Kent, Ardrossan, recently had her trial trip. She was launched in August last, and was the first steel vessel built by the Ardrossan Shipbuilding Company. The dimensions of the yacht are:—Length, 149 ft. over all; breadth, moulded, 22 ft.; depth, 13.6 ft.; 304 tons, yacht measurement. She is fitted with triple-expansion engines, which indicate 650 H.P., and is furnished with Joy's valve gear, actuating patent piston valves on high-pressure engines, and intermediate and low-pressure patent trick-valves. Each engine has a boiler for itself, so that they can be worked combined or separately. Drysdale's patent centrifugal pumps and Worthington steam pumps are used for feeding the boilers. She has a donkey boiler and a duplex donkey engine for fire purposes. The engines are by Messrs. Muir & Houston, Harbour Engine Works, Kinning Park, Glasgow. The yacht is also supplied with patent syren fog-horns, and powerful steam whistle, and Green's air-engine for forced draughts and ventilation. The engines and boilers are built in accordance with the Admiralty specifications and requirements. Although designed and fitted up as a yacht, the *Ormea* can be utilised for other purposes than mere pleasure. Designed similar to the swift cruisers of the *Galatea* type, she has every facility to engage in warfare. With her twin propellers she can manœuvre quickly, her boilers are protected by her coal bunkers, and her rudder is out of reach of shot and shell by being entirely immersed, and her steel deck sheathed with teak forms a strong platform to fight her guns upon, at the same time giving protection to the men below; or should one of our merchant ships get ashore or sunk, and require the services of the salvage corps, the *Ormea* can, in her spacious hold, take boiler, pumps, and fittings to the scene of the disaster. In this kind of work often it is most difficult to get accommodation for the men required, but the *Ormea* can give sleeping accommodation for over 40 men besides her crew, and after the salvage corps has successfully floated the disabled craft, the powerful towing gear with which this vessel is fitted can be brought into play, and a 3,000-ton merchant ship towed to the desired port. The *Ormea* has a much arger displacement than the ordinary yacht, which gives her great carrying capacity. There are stowed in the tanks about 12 tons of fresh water, while her bunkers carry about 130 tons f coal, sufficient, at moderate speed, for about 26 days' steaming. This can be considerably increased by carrying a further supply of coals in the hold. On deck is fitted a powerful winch, with derrick, capable of lifting 10 tons out of or into the hold. A powerful windlass, by Napier, was tested on the trip, and with the greatest ease lifts both the ship's anchors (which are extra heavy) at one time.

ELECTRIC LIGHT INSTALLATION AT THE WORKS OF THE WALLSEND PONTOON COMPANY, LIMITED, CARDIFF.

THE installation of electric light at the Engineering and Shipbuilding Repairing Works of the Wallsend Pontoon Co., Limited, Cardiff, presents some features of interest. The motive power for driving the dynamo is obtained from a large gas engine, which also assists another gas engine in driving the extensive machinery of the shops. Owing to the varying load, arising from machines being suddenly started and stopped, special arrangements were requisite to ensure that the working of the electric light was not interfered with, and this has been very successfully achieved by the adoption of a Thomson Dynamo Electric Machine, manufactured by the Thomson Houston Electric Co., which is fitted with Thomson's Air Blast, Patent (1888), and Automatic Regulator. The dynamo generates 950 volts. at 6·8 ampères, and is kept in motion from 3.30 p.m. to 8 a.m. As, during that time, all the lamps are not in use, a storage arrangement has been made whereby the surplus electricity is stored. This consists of 25 5-L. Electric Power Storage Company's Accumulators of their 1888 type, through which all the current passes, the surplus power being left in the accumulators; and sufficient is stored during the night to supply the incandescent lamps during the day. The entire installation consists of 18 1,200 candle-power arc lamps (Thomson & Houston's), and 30 of Swan & Edison's incandescent lamps. Fourteen of the former are distributed throughout the shops, and four are conveniently placed at the Pontoon Dock, having an arrangement whereby they can be raised or lowered so as to facilitate working at a vessel on the pontoons, and for examination of the bilges and bottom. The dynamo is not of itself sufficiently powerful to provide the electrical power for all the lamps at once, but is in conjunction with the stored electrical power, the storage batteries giving a supply of 12 ampères A feature of the installation is that, however the e.m.f. varies, the current remains continuous. It is also interesting to note that the dynamo's normal speed is 750 revolutions per minute, but, should only 300 revolutions be, from any reason obtainable, still, seven of the arc lamps can be kept lighted without the assistance of the accumulators; and, similarly, at 100 revolutions, one or two of the lamps can be kept in operation. The switches used on the installation are Laing, Wharton & Down's, but they have an important modifi cation, specially arranged for the Thomson & Houston Co. It consists in having the spring fitted at the back instead of the front, and facilitates the renewal of the contacts as they wear. There is also fitted a novel automatic switch for the purpose of preventing the reversal of the current, which we hope to describe at a future date. Similar installations to that now described would appear to be specially suited to the exigencies of electric lighting on board sea-going vessels.

Correspondence.

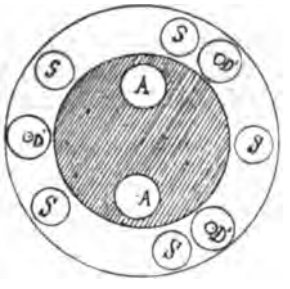
[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

BREAKDOWN AT SEA.

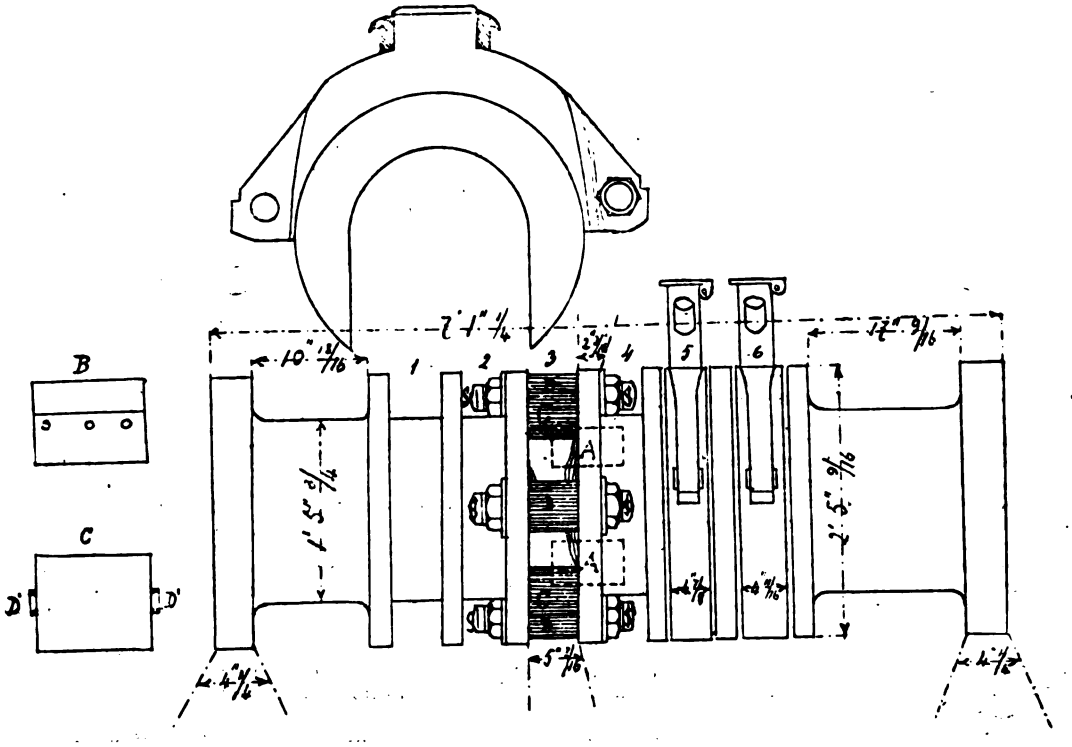
To the Editor of The Marine Engineer.

Sir,—As a subscriber to your valuable and most interesting paper I take the liberty of sending you some information about a breakdown at sea which happened to the s.s. *Perseo* of the Navigazione Generale Italiana, Rome, thinking it may prove useful to your readers, and especially to my brother sea-going

engineers. A few remarks about the s.s. *Perseo* are not out of place. She was built by Messrs. Robert Napier & Sons, at [illegible] and was launched on November 16th, 1883, for the



Società Italiana di Trasporti Marittimi, Raggio & Co., Genoa, and is specially designed to meet the requirements of the South American service running between Genoa and the River Plate. The general dimensions are:—Gross tonnage, about 4,400; length between perpendiculars, 380 ft.; breadth, 42 ft.; depth, moulded, 33 ft. 6 in., and she is fitted with three cylinder compound engines capable of indicating 4,500 H.P. She was performing her homeward passage, and carried over 400 passengers, when in s. latitude 0 deg. 22 min., w. longitude 31 deg. 18 min., the main shaft, 17¾ in. diameter, broke within the thrust block. Mr. S. Grillo, chief engineer in charge, made the following repairs as shown in the sketch herewith. He had the two parts of the broken shaft lifted up on deck, and also fitted on deck a lathe which he drove with a leather belt, from a steam winch. He then took all the iron on board of useful size, viz., stock anchors, stanchions, crank shaft bolts, and bed platform bolts with which he made the necessary bolts and tools to bore the several holes for five bolts, 3⅜ in. diameter screwed both ends, two bolts AA 4 inches diameter acting as levers, three cylindrical pieces, C 5¼ in. diameter, keeping the two parts at the fixed distance, and five liners B ½ in. thick for the same object. The work absorbed eight full days, working day and night, continually, through excessively warm and rainy weather. After eight days the shaft was lowered down and fitted in its place, and thus, with only two collars working in the thrust block, and a speed of 7·5 knots per hour, the s.s. *Perseo* reached Genoa, after touching at S. Vincenzo (Cape Verde) and Barcelona.



With my best regards and thanks, believe me, sir,

Yours faithfully,

M. LIGNAROLO.

TRADE NOTES.

To the Editor of THE MARINE ENGINEER.

SIR,—In your number for this month, under the heading "Industrial Notes, Clyde and the East of Scotland," you say the new ship *Liverpool* launched last month on the Clyde, is 125 feet longer than the *Palgrave* which was, up to that time, the largest sailing ship afloat. This is incorrect, the dimensions of the *Palgrave* being, according to THE MARINE ENGINEER for September, 1884, 340 by 49 by 25-8, tonnage 3173, the *Liverpool* being 333 by 47-10 by 26-6, tonnage 3377, the *Palgrave* is thus longer and wider, but being 204 tons less is of course the smaller of the two ships.

In your "Trade Notes" for the Hartlepools you say, "To this Messrs. W. Gray and Co. contributed over 50,000 tons, a production which has hitherto never been reached at any single shipbuilding yard," This is incorrect. Messrs. Gray's output this year is 50,307 tons, whilst in 1882 Messrs. Palmer's was 60,379, and in 1883 no less than 61,113 tons. This year Palmer's is 47,076 tons.

In your Shipbuilding returns should be added to that of Alexander Stephens & Sons, Clyde, the sailing ship *Carr Rock* 1,660 tons. This ship was included in the totals, but not in the details.

John Reid & Co., Port Glasgow, of which you do not give the details, only the total, is as follows:—

Adderley,	Steel,	Sail,	1,239	
Banklands,	,,	,,	1,239	
Tacora,	Iron,	,,	911	
Thetis,	Steel,	Steam	1,806	120 H. P.
			5,195	

I think you will find all these particulars correct. I am, sir,

Yours Obediently,

GEORGE W. GREEN.

P.S.—The following vessels have also been omitted from your Shipbuilding Returns. Sailing ships *Sutlej* of 1,742 tons, by C. H. Hill & Co., Bristol, and the *Kinkora* of 1,830 tons, by Ritson & Co., Maryport; all of which were duly chronicled in your pages at the time of launching.

Reviews.

Boilers: their Construction and Strength. By T. W. Traill, F.E.R.N., Engineer Surveyor-in-Chief to the Board of Trade. London: Charles Griffin & Co.

A book on boilers by such an authority as Mr. Traill cannot but prove a welcome and valuable addition to the already-existing and by no means unimportant literature of the subject.

If we may be allowed to use the simile, the present work would, in the hands of the amateur, prove like "strong meat" to the sick man; but placed in the hands of the practical engineer or boiler-maker, its value as a ready, reliable, and widely-comprehensive book of reference, must indeed prove almost inestimable.

If only that part of the work which tells, in lucid language, what to do, and how best to do it, in the construction of boilers, had been published, it would deserve to rank high as a standard work on the subject; but when we bear in mind that this information is supplemented by the addition of tables dealing with all possible phases of the subject, and giving in all some 60,000 results, to obtain which in the ordinary way it has been estimated some 6,000,000 figures would have had to be employed, and the accuracy of each one of which has been ensured by computation and separate re-computation, it will, we think, be acknowledged that the present work may fairly claim to be unique in its scope, and perfect of its kind, so far as perfection can be attained. As showing the wide range of the work, we will briefly enumerate the headings of the chapters into which it is divided, prefacing this with the remark that the notes as to the use of the different tables given in the chapters are both copious and sufficiently explanatory for the purpose; while numerous simple formulæ, interspersed throughout the book, enable those who may prefer it to calculate the results given independently for themselves, or to carry them on to larger dimensions than those already given.

The first chapter deals concisely, but exhaustively, with that most important subject, "Materials for Boilers." This is followed, in the order given, by chapters on "Iron Boilers," "Steel Boilers"; "Boilers, General"; "Rivetting, Iron and Steel"; "Flanged Mouthpieces, Iron and Steel"; "Flat Surfaces, Iron Plates"; "Iron Stays, Stress per square inch, 5,000 lbs."; "Iron Stays, Stress per square inch, 7,000 lbs."; "Iron Girders for Flat Surfaces"; "Cylindrical Boiler Shells, Iron"; "Iron Plates and Iron Rivets—Rivetted Joints"; "Furnaces, Plain Cylindrical—Iron Plates"; "Furnaces with Flanged Joints—Iron Plates"; "Furnaces, Corrugated, Cylindrical—Iron Plates." Under the general heading, "Steel Boilers," the following chapters are given, viz.:—"Flat Surfaces, Steel Plates"; "Steel Stays, Stress per square inch, 9,000 lbs."; "Steel Girders for Flat Surfaces"; "Cylindrical Boiler Shells, Steel"; "Steel Plates and Steel Rivets—Rivetted Joints"; "Furnaces, Plain Cylindrical—Steel Plates"; "Furnaces with Flanged Joints, Steel Plates"; "Furnaces, Corrugated, Cylindrical—Steel Plates"; "Furnaces with Ribbed Projections—Steel Plates"; and "Spiral Corrugated Furnaces—Steel plates." These chapters complete what may be called the constructive part of the work, the remaining chapters and tables relate to areas, and circumference of circles; numbers, decimal equivalents, squares and cubes; inches and their equivalent decimals; decimal fractions and their approximate values in vulgar-fractions; fourth powers; weights and measures: water, pure and salt; and weights and specific gravities of metals; safety valves; spring safety valves; spiral springs for safety valves; and properties of saturated steam.

The book is published in two sizes, the larger one being designed for use as a hand-book, and the smaller one, bound in leather, for the pocket.

Taken altogether we can strongly recommend Mr. Traill's book as being the most complete, eminently practical, and most recent work on the subject.

A Practical Treatise on the Steam Engine Indicator and Indicator Diagrams. By "Amice." Edited and enlarged by W. Worbey Beaumont. London: The "Electrician" Printing and Publishing Co., Limited.

To those who may be anxious not only to take an indicator card, but also to know all the ins and outs, theoretical and practical, of the object, construction, and use of the indicator, we heartily commend this most practically useful book.

The writer is evidently thoroughly well versed in the whole subject of indicators and indication, and shows by his writing that he is quite capable of imparting to others in a clear and lucid style, the benefit of his knowledge of the subject, and that too without lengthy discussion of theoretical or hypothetical matters, which although of great scientific importance do not immediately concern those whose desire is to understand the practical employment of the indicator as used by those interested in any way with the working of steam and other motors.

Throughout the book simple arithmetical treatment has been adopted so as to render it useful to practical men, and the object of the book is perhaps best shown by the sequence or order upon which the author has proceeded, and which may be briefly set out as follows:—To consider the object of an indicator diagram, or what it is desired that it shall show; to describe the indicator in its various forms, as successively devised for this purpose; to describe the apparatus for attaching the indicator to the engine, and how to use the instrument; to give examples of diagrams from all kinds of engines most in use; to interpret these diagrams and to show how far they agree with theoretical diagrams; to show the most simple methods of calculating and constructing theoretical modes of expansion, and of comparing in particular cases the actual with the theoretical performance of steam in the steam engine cylinder. The illustrations are numerous and good, and the book throughout is a credit to author and publisher alike.

The Steam Boiler Catechism. By Robt. Grimshaw. New York: Practical Publishing Co.

Treating, as it does, in an eminently practical manner with the whole subject of the properties of steam and fuels, and the theory and practice of designing, construction, setting, connecting, testing, firing and repairing almost every known type of boiler, this handy little manual cannot but prove useful alike to steam engineers and firemen, as to boiler owners and builders. The author, while not claiming any originality for the book, or expecting it to be capable of answering every question which might be asked concerning a steam-boiler, may certainly take credit to himself for having compressed more of "the sum of the personal knowledge of thousands of others" into a little volume, than many other writers on kindred subjects have managed to get within the covers of a comparatively ponderous tome.

Briefly we may say that the book is not intended as a means of instructing those who are expert in constructing, or efficient in running the appliances which it treats of, but is rather issued with the hope that it may serve the well-posted as a handy reminder at times when, from haste or lapse of time, or mental pressure, the memory is not wholly reliable. Throughout the book aims to be absolutely accurate, and unmistakably direct, simple and clear, and to ensure accuracy the author, where expert opinions differ, gives both sides of the question with perfect impartiality. The book is well printed and copiously illustrated, and is not too bulky for the pocket.

Nautical Terms in English and French. With useful Tables. By Leon Delbos, M.A., H.M.S. *Britannia*. London: Williams & Norgate.

Mons. Delbos' most useful compilation of nautical terms in the two languages cannot fail but prove of value to all seagoing officers, whether they be of the Royal or Merchant Service.

The author has taken more than ordinary precautions to ensure that the book throughout should be, in every sense of the word, strictly accurate, and after a careful perusal of the book we are not able to detect any errors; indeed, the system used by the author for verifying all the terms relating to parts of the ship, or to her rigging, and in short, all words used in seamanship, and the care exercised in testing the words of command over and over again, go far towards precluding the possibility of any error being made.

The book concludes with a series of useful tables, giving the equivalents in French and English of weights and measures, coinage, the equivalent in French millimetres of the English barometer scale, and particulars regarding the Centigrade, Rhaumur, and Fahrenheit thermometers.

The utility of such a book is obvious, and it only remains for us to say that it is of a convenient size for the pocket, neatly and strongly bound and well printed.

The Mechanical World Pocket Diary and Year Book for 1889. Manchester: Emmott & Co., New Bridge Street

This most handy little pocket-book (published at the modest price of sixpence) should be in the possession of all engineers, draughtsmen, and mechanics, as it contains in a not too bulky form, a very comprehensive collection of practical rules and tables for everyday use in engineering practice.

In addition to the rules and formulæ, all of which it is impossible to carry in one's mind, the book serves the ordinary purposes of a diary, fifty-two properly printed and sub-divided pages being set apart for the purpose, as are also several blank pages for memoranda.

There is much that is both useful and interesting in the pages of this little book, but perhaps we may mention as being of especial interest to our readers that there is a very useful "Table showing the mean pressure of steam in cylinders of compound and triple expansion engines, with various initial steam pressures, worked down to a nominal terminal pressure of 15 lbs. per square inch"; a table giving "particulars of triple-expansion engines for small cargo steamers"; a table giving the "indicated horse-power of triple-expansion engines," and also some very interesting "particulars of triple-expansion marine engines, collated from recent practice." Having regard to its price the book is well bound and illustrated.

Miscellaneous.

Fast Ocean Steaming.—The remarkably fast passage of the Castle liner *Roslin Castle*, the engines of which were lately tripled by Messrs. Richardson, of West Hartlepool, proves to have been completed in a much shorter steaming time than any previously recorded voyage between England and the Cape. Leaving Dartmouth at 4 p.m., on the 7th of December, the *Roslin Castle* reached Cape Town at 1 p.m., on Wednesday, the 26th of December, having called at Lisbon, Madeira, and St. Helena. The entire distance, 6,102 knots, was covered in 18 days 21 hours, the net steaming time being 17 days 18 hours 30 minutes; average speed 14·35 knots.

A Japanese Floating Fort.—The Japanese admiral Akamatsu is said to have invented a new floating fort for coast defence. This fort is to be built on a kind of vessel made of steel, and 150 ft. in length. The armour is to be 12 in. thick, and the bridge will be specially protected with a steel bulwark of 3 in. It is to have a double screw and engines of 200 H.P., capable of attaining a speed of three miles an hour. On the first bridge will be placed 12 15-centimetre cannon, and on the second, eight 26-centimetre. The crew will number 250 men, and each floating fort is estimated to cost £400,000, but this is obviously a mistake; perhaps £40,000 is meant.

A Pneumatic Yacht.—A pneumatic yacht, called the *Eureka*, has recently been launched at Brooklyn. The vessel is 100 ft. long, and her extreme breadth is 12 ft.; but the remarkable feature of her construction is the method of propulsion. A series of tubes are fitted in the bow, with their muzzles opening under water, and they are divided internally into a number of chambers for the reception of a mixture of gaseous fuel and air. The contents are exploded in rapid succession, by means of an electric spark, and the impact of the expanding gases against the surrounding water is sufficient to propel the vessel. It is stated that the method of propulsion has been demonstrated as feasible, and that the performances of the vessel will be watched with interest. There is more novelty in this arrangement than in many of the so-called American inventions, but it is hardly probable that either screw or paddle propulsion will suffer by its rivalry.

A Channel Service from Dover to Boulogne.—According to the *Dover Standard* a new company is in course of formation for running a service of mail packets between Dover and Boulogne, and will be styled the "Cross-Channel Steam Shipping Company (Limited)." The promoters state that the company is to be formed for the purpose of establishing a line of large and swift passenger steamers between Dover and Boulogne, and give several reasons why, in the course of time, the Dover-Boulogne route must be superior to the Dover-Calais route. The real advantage which would be obtained by a Dover and Boulogne route would be a shortened journey to Paris—the sea passage, which is one mile shorter than from Folkestone, being performed by larger steamers than could be accommodated at that place. A contract has just been entered into with the Fairfield Shipbuilding Company to build and deliver by the 1st of June three steamships of 1,500 tons each with a guaranteed speed of 26 miles per hour in ordinary weather. The journey to Boulogne from Dover, it is said, "will therefore be accomplished with regularity as quickly as that from Dover to Calais, and the time will be saved which is taken up at present by travelling from Calais to Boulogne on a piece of line which has proved dangerous by slips which have occasionally taken place there and caused considerable delay." In order to expedite the opening of the Dover to Boulogne route two large and powerful vessels belonging to the Isle of Man Steam Packet Company have been chartered for the purpose, and the steamers will, it is stated, commence running as soon as practicable, although it is not expected that these vessels will equal the speed of the steamers which the company have contracted for. It is proposed that the boats shall run in correspondence with the existing train service on both sides of the Channel, and it is anticipated that the journey from Dover to Paris will be performed in seven hours. A very large increase in the passenger traffic is expected during the present year owing to the Paris Exhibition, and the company naturally expect a considerable share of the traffic. The Chamber of Commerce at Boulogne have accorded their active support to the scheme.

Surprise.—On January 16th inst. the screw steam launch *Surprise* went on her official trial trip on the river Colne. Her machinery is of the compound-surface condensing type, with outside condenser; working pressure in boiler, 100 lb. The principal dimensions of the hull are:—Length, 34 ft.; breadth, 10 ft. 6 in.; depth, 4 ft. 3 in. The *Surprise* was built by Messrs. Forrestt & Son, at their Wyvenhoe ship yard, for the Colchester Oyster Fishery Co., and is to be used as an oyster dredger; her speed was considered highly satisfactory.

Enterprise.—On January 21st the composite screw steam tug *Enterprise*, built by Messrs. Forrestt & Son, of Wyvenhoe and Limehouse, London, went on her official trial trip on the river Colne. The speed obtained was over 10 miles per hour, which was considered highly satisfactory. Her principal dimensions are:—Length, 45 ft. by 8 ft. 9 in. by 5 ft. The machinery is of the compound-surface condensing type. Cylinders, 7 in. by 14 in. by 10 in. stroke. Marine return tube boiler, with large heating surface; steam working pressure, 80 lb. She is intended for service on the Colne.

Recent applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from December 17th, 1888, to January 12th, 1889.

17138 R. Hamilton & J. Walker. Propulsion of ships.
17144 T. Banner. Metallic packing and box for valve rods.
17148 J. Shaw & R. Alexander. Feed-water heaters.
17156 J. Whittle. Condenser, economiser, and feed-water heater for steam engines.
17168 A. J. Agar. Steam vessels.
17193 R. H. Tookey. Parapet mountings for machine guns.
17208 G. L. Watson & J. Thom. Guiding sails on the spars of vessels.
17216 E. B. Benham. Compound steam engines.
17281 H. J. H. King. Multiple cylinder engines.
17287 W. P. Lynam. Range finding.
17293 J. Gullery. Steam trap.
17299 A. Morton. Motive power engines.
17323 R. A. E. Scott. Heavy ordnance and projectiles.
17329 A. Keltar & A. J. Marquand. Cutting boiler and other tubes.
17335 W. Phillips. Boiler furnace flue.
17342 J. A. Radiquet. Rotary engines.
17343 W. Schmidt. Steam and air motor.
17354 J. Allan & E. S. Dixon. Furnaces of marine and other boilers.
17356 J. Rettie, F. W. E. Gruggen, & H. J. Peechey. Utilising power of water in motion.
17407 R. Tobin. Steam generators.
17412 Lake (Company Gewerkschaft Schulz, Knaudt). Steam boilers.
17422 T. Utley. Ship's side-light ventilator.
17423 T. G. Stevens. Engine governor.

17424 J. Murrie. Feed-water mechanism.
17425 J. Buchanan. Fluid pressure and vacuum gauges.
17430 H. Brockmann. Propulsion of boats.
17451 Day (P. S. Swan). Stop valves.
17501 J. A. Rowe. Automatically discharging guns on vessels at sea.
17512 A Fisher, jun., & R. Richardson. Steam and hand steering gear.
17540 E. Skoda. Recoil brakes for guns.
17557 G. Kingdon. Marine boiler.
17561 E. Skoda. Automatic quick-firing guns.
17573 J. Proctor. Mechanical stokers.
17578 S. A. de Normanville. Taps, cocks or valves.
17595 A. Layer. Utilisation of the force of sea waves.
17595 W. J. Jeffery. Rifling and bore of machine guns, &c.
17596 B. S. Weston. Tidal tug.
17603 Dymond (M. J. J. Rescke). Propelling boats.
17610 W. Tully. Regulating supply of steam, &c., to engines.
17617 A. McInness. Production of forced draught in steam boiler furnaces.
17625 T. G. Stevens. Windlass and winch brake.
17634 W. Anderson. Mounting ordnance.
17647 R. Brown. Steam boiler water gauge.
17685 Jordan (M. J. O'Farrell). Range plate for guns.
17695 F. Stitzel & C. Weinedel. Semaphore signalling apparatus.
17696 H. A. Strong. Water motors.
17705 M. P. Baxter. Steering and stopping ships.
17711 W. J. Reynolds. Ascertaining deviation of ship's course.
17717 J. Willis. Steam boilers.
17724 R. Hargraves. Corlis' valve gears.
17725 S. Irvine & Sons. Paddle raft.
17726 E. A. Slade. Packing for stuffing boxes.
17744 Brierley (W. Wilson & J. Sparrow). Steam traps.
17761 F. R. Martin. Reversible rotary engine.
17770 Wallace (P. Scott). Flash signalling apparatus.
17772 W. S. Simpson. Explosive shells.
17800 S. Eddington & J. E. Steevenson. Re-heating steam between high and low pressure cylinders.
17802 F. Holt. Tubular boilers.
17804 C. A. Knight. Steam generators.
17833 W. M. Smith. Piston valves.
17862 J. E. Lawrence. Centrifugal pumps.
17868 J. C. Wilcox. Life-saving belts.
17889 J. Dickson. Steel shells or projectiles.
17891 F. H. Snyder. Explosive shells.
17904 J. Willoughby. Forced draught, &c.
17908 M. E. Hershey. Steam boiler settings.
17910 Dymond (G. W. Napier). Causing a vessel to draw more or less water.
17913 W. Lockwood. Pistons, &c.
17927 A. C. Boursot. Steering indicator.
17932 W. D. Bruce & W. Shapton. Dredgers.
17943 J. Blake. Steam generators.
17944 Dymond (F. J. Laun). Motive power engines.
17946 F. J. Binns & R. J. Paris. Protecting ships' bottoms.
17956 H. Hackney. Steam boilers.
17980 E. B. Andrews. Tidal engine.
18019 G. C. Lilley. Spirit or liquid compasses.
18034 S. A. Ward. Generating steam.
18047 W. Simpson, A. Francis, R. Skirrow, & S. Smart. Rotary motor.
18053 Tongue (J. M. Mitchell). Steam traps.
18055 J. & W. Hastie. Steam motor.
18085 A. E. Tavernier & E. Casper. Pressure gauge.
18089 D. Joy. Flues or fire-boxes.
18095 J. Ross. Steam chests and slide valves.
18095 G. Taylor. Shipment of coal, &c.
18115 G. Shepheard. Range finder.
18130 S. Lloyd. Hauling or towing vessels.
18142 F. R. J. Matthews. Collapsing boats.
18147 S. Washington. Rotatory engines.
18152 G. Spencer. Reducing valves.
18169 Redfern (O. H. Castle). Steam engine governor.
18170 F. A. Pommier, jun. Marine signal lamps.
18181 T. Nordenfelt. Base fuses for projectiles.
18186 E. J. Barker. Shutting off fluids, &c.
18200 J. Moxley & B. Blundstone. Engine packing.
18209 O. E. Hoffman. Boats or rafts.
18213 J. Daglish & J. E. L. Ogden. Circulation of water in marine boilers.
18215 S. A. Johnson. Tube stopper for boilers.
18262 P. W. Lothmann & Co. (H. Kroll). Speed regulator for marine engines.
18277 W. Sandbrook. Hurricane, or wind-proof lantern.
18312 W. Booth. Furnaces.
18324 Heys (Schaeffer & Budenberg). Speed indicator for ships.
18332 D. Johnston. Feed water heaters for steam boilers.
18355 W. Burnell. Compound engines.
18364 R. Hack & R. E. Plaistowe. Registering the movement of pistons, &c.
18391 A. G. Brown. Compound steam engines.
18393 G. Twigden & W. H. Hick. Metallic gland packing.
18398 R. P. Atkins & R. J. Rae. Steering vessels.
18407 J. Chandler. Removing sand banks, deepening rivers, &c.
18414 C. A. Piat. Furnaces.
18424 W. H. Wilson & W. J. Pirrie. Deck house, side light and ventilator combined.
18430 E. E. Pritchard. Auxiliary steering and break power for ships.
18431 J. T. Case. Steam engines.
18435 W. Burnham. Returning water of condensation to boiler.
18449 J. Williams. Steam engines.
18464 J. White. Pumps.
18466 G. Quick. Breech mechanism for ordnance.
18472 J. H. Ritchie. Valves and cocks.
18476 D. Steinmann-Haghe. Discharging of vessels.
18484 J. Thom. Slide valves.
18499 J. Gibson. Bell buoy.
18510 W. R. Briggs & F. C. Lyon. Oar locks.
18511 Jensen (D. B. Burnham). Steam pumps.
18513 J. F. Roseberry. Motors.
18514 N. Richardson. Bilge-water pumps.
18527 C. L. Smith. Self-closing buckets for dredging.
18543 J. & B. Wild. Steam engine governor.
18553 C. A. Benson. Range finder.
18556 J. Pollock. Steam boiler water purifier.
18563 E. Cory. Automatic water raisers.
18592 F. Russell. Propelling boats.
18602 Clark (The Dake Engine Manufacturing Co.). Steam engine.
18617 W. G. Talbot, J. Money & C. Roe. Range finders.
18629 W. Chilton. High-speed compound engines.
18688 W. Paterson & W. B. Cumming. Watertight bulkhead doors.
18691 Tangyes, Ld. & T. Meacock. Governors for pumps.
18696 Dymond (F. Schmidt & V. Landsberg). Projectiles.
18704 R. Marshall. Furnaces, or fire boxes.
18713 C. C. Daevel. Screw propellers.
18734 G. H. Denison & E. J. Holmes. Smoke consuming apparatus for boiler furnaces.
18750 M. Smith. Supply fuel to boiler furnaces.
18772 J. A. Fowler. Packing stuffing boxes under pressure.
18774 W. P. Bullivant. Attaching torpedo nets to their ridge rope.
18777 A. Franz. Motors driven by steam, &c.
18785 G. Quick. Breech-loading ordnance.
18798 G. A. Franke. Variable expansion gear for steam engines.
18803 J. Davies & T. Walmsley. Steam generator furnaces.
18831 Johnson (La Société Salomon Fréres et Tenting). Screw propellers.
18837 G. Quick. Breech-loading ordnance.
18840 H. G. Cameron. Ships' steering gear.
18848 A. A. & F. E. Bushell. Propulsion of ships and boats.
18853 G. B. Field. Feed water-heaters and purifiers for steam boilers.
18863 M. Blumrich. Vapour engines.
18882 W. Duff. Steam boilers.
18924 P. J. Murphy. Registering ships' speed.
18961 Johnson (J. M. Guibal). Piston-rod stuffing box-packing.
18968 E. L. Zalinski & H. J. Smith. Primers or igniters for torpedoes, &c.
18982 P. Roscow & M. Settle. Boiler furnaces.
18989 T. J. & W. J. Disturnal. Furnace grates.
18990 J. Linkleter. Lowering and detaching boats.

19008 Boult (C. F. Fogg). Rotary engine.
19026 J. & W. Williams. Steam trap.
19038 J. E. Carroll. Feed-water purifiers.
19041 T. Bentley & W. Calvert. Reducing valves for steam or water.
19057 E. Dobson. Consuming or preventing smoke in boiler furnaces.
19063 W. Thomson & J. M. Macgregor. Piston packing rings.
28 G. Alexis Godillot. Furnace grates.
26 E. Lawson. Ships' berths.
48 Brookes (C. Worthington). Valve gear.
49 C. Kelway. Ordnance projectiles.
58 R. Scott. Steam boilers.
70 E. B. Muller. Smoke consumer for boilers.
79 E. S. Harpst. Steam engines.
122 Dymond (H. Piron). Furnace grates.
148 R. Casslett. Preventing incrustation in boilers.
186 J. & H. Stevenson. Obtaining fresh water from salt water.
247 P. Thomas. Utilising exhaust steam for evaporating liquids.
251 R. Southworth. Projectiles.
288 T. Nordenfelt. Cartridges for large guns.
289 W. Shapton. Loading vessels.
290 J. Trill. Expansion gear for steam engines.
311 A. H. Williams. Raft seats.
314 S. Pope & J. Duce. Armour plates for ships.
316 J. Davies. Furnaces for steam generators.
323 D. P. Davis. Steam engine governor.
333 J. A. Wanklyn. Treating sea-water for use in steam boilers.
343 Newton (J. Thorne). Rotary engines.
344 H. Gourlay. Steam boilers.
348 J. W. Coulston. Signal lights for vessels.
349 Imray (P. B. Viele). Stopping leaks in ships.
364 J. & J. Anthony. Steam boilers.
384 Sanderson (J. O'Brien & S. J. Weaver). Removing impurities from water in steam boilers.
391 G. Aylwin. Gland metal packing.
410 A. & W. Pickard. Construction of canals, &c.
426 J. Jackson. Force pumps for filling and testing boilers.
438 J. Kirkaldy. Obtaining fresh water for making up waste in marine engines.
452 J. L. Roe-Browne & J. Green. Signalling between ships.
478 J. Kirkman. Gland packing.
536 C. Baddeley. Cleaning boiler tubes.
538 J. Newton & D. A. Quiggin. Distilling sea, &c., water.
541 J. Frick. Forcing, pumping and compressing fluids.
574 A. G. Hay. Steam and other engines.
587 A. Gibb. Gland packing.
607 W. D. Pratt. Preventing incrustation in steam boilers.
615 W. M. Walters. Lighthouses.
616 Ditto Ships' lights.
620 A. H. Smith. Cocks and valves.
628 F. H. Snyder. Projectiles or shells.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1 C, denotes First Class; 2 C, Second Class.

December 8th, 1888.

Bone, H.	2C	London
Boyd, T. A.	1C	Liverpool
Burdon, H.	2C	N. Shields
Christie, G.	1C	Glasgow
Collard, A. S.	1C	Liverpool
Croft, A. W.	1C	N. Shields
Cullen, M.	2C	Glasgow
Currie, R. S.	1C	,,
Earle, W. K.	2C	Liverpool
Ewer, J.	2C	Greenock
Francis, J.	1C	Cardiff
Galstaun, P.	2C	Glasgow
Hardie, J.	2C	,,
Hurry, A.	2C	,,
Johns, H. W.	1C	Cardiff
Kendall, J.	1C	Liverpool
Kerr, J. J.	1C	,,
King, J. C.	1C	Glasgow
Longridge, H.	2C	Liverpool
McInnes, A.	2C	Glasgow
McNaughton, J.	2C	,,
Maher, E.	1C	Dublin
Marshall, N.	1C	Liverpool
Martin, W.	2C	London
Moffatt, H. T.	2C	N. Shields
Moneur, J.	2C	Glasgow
Murta, W. T.	1C	Cardiff
Park, W.	2C	Liverpool
Peacock, A.	1C	N. Shields
Sharpless, G. W.	2C	Cardiff
Skinner, G. W.	1C	London
Smith, A.	1C	Glasgow
Strapp, J.	2C	,,
Thornton, T.	2C	N. Shields
White, J. W. G.	2C	London
White, W. F.	1C	N. Shields

December 15th, 1888.

Brown, J. M.	1C	N. Shields
Clarke, Isaac	2C	W. Htl'p'l
Cook, A.	2C	N. Shields
Coveney, W. C.	1C	Leith
Davison, G.	2C	London
Garland, J.	2C	Dundee
Hair, J. C.	2C	L'pool
Hogarth, R.	2C	N. Shields
Houfe, W. W.	2C	Leith
Hunter, P.	2C	,,
Lamb, J.	1C	,,
Lester, E. S. R.	1C	Liverpool
McOmbie, G.	1C	N. Shields
Parkinson, W. B.	2C	London
Phillips, H.	1C	Liverpool
Raeburn, W.	1C	Greenock
Robbins, J. B.	1C	London
Smart, A. W.	2C	Leith
Steele, A. E.	1C	,,
Stephenson, G. F.	2C	N. Shields
Swan, P.	2C	,,
Tunstall, John	1C	Liverpool
Wallace, D.	2C	,,
Wetherall, T.	2C	N. Shields
Wilson, John	2C	Liverpool

December 22nd, 1888.

Anderson, J.	2C	Glasgow
Anthony, J.	2C	N. Shields
Barbour, J.	1C	Glasgow
Brigham, R. F.	2C	N. Shields
Brown, J. R.	2C	Aberdeen
Cama, N. B.	1C	N. Shields
Chard, A. W.	2C	London
Constable, P.	2C	Cardiff
Duncan, D.	1C	Glasgow
Foster, G. H.	1C	London
Glegg, J.	2C	South'pt'n
Grant, C.	1C	Cardiff
Hanson, W.	1C	London
Kelly, A.	1C	Glasgow
Kent, R.	1C	Cardiff
Latta, J. G.	2C	Glasgow
Lockhart, J.	2C	,,
Mitchell, C. R.	2C	Aberdeen
Moncrieff, P.	2C	N. Shields
Murphy, P.	1C	Glasgow
Paxton, H. S.	2C	Leith
Ruxton, J. K.	2C	Glasgow
Silversides, R. H.	1C	N. Shields
Smith, J.	2C	Aberdeen
Sutherland, D.	2C	Aberdeen
Swenson, C. A.	1C	Cardiff
Thomas, W. H.	1C	Falmouth

December 29th, 1888.

Anderson, G. H.	1C	Sund'l'd
Bagnall, W. F.	2C	N. Shields
Carr, R.	1C	Sund'l'd
Dobson, C. W.	1C	,,
Donati, C. R.	2C	London
Evans, R. H.	2C	Sund'l'd
Grice, Wm. H.	1C	N. Shields
Harley, T.	2C	,,
Jackson, J. W.	1C	,,
James, W.	2C	,,
Lee, W.	1C	Sund'l'd
Moffitt, R. J.	2C	N. Shields
Paxton, W. F.	2C	London
Proctor, G. D.	1C	Sund'l'd
Robinson, J. B.	2C	N. Shields
Rusden, H.	1C	,,
Swapp, G.	2C	,,
Taylor, W.	2C	Sund'l'd
Wiseman, H.	1C	,,
Wright, T.	1C	N. Shields
Wylie, J.	1C	,,

January 5th, 1889.

Aitken, George	2C	Glasgow
Babtie, Chas. J.	2C	,,
Barrie, A. E.	2C	Glasgow
Birch, Chas. E.	2C	Hull
Brown, James	1C	Glasgow
Bruce, H. Jones	2C	Cardiff
Conway, W. O.	1C	,,
Cook, Edward	2C	,,
Denholm, Alex.	1C	Glasgow
Davidson, Alex.	1C	,,
Dawe, W. H.	1C	Cardiff
Gill, Wm.	2C	,,
Harris, Geo. A.	1C	London
Heath, George	2C	,,
Hobbs, Robt.	1C	Cardiff
Hodgson, John	2C	Hull
Jacklin, Wm.	2C	,,
James, Ernest A.	2C	Cardiff
Lewis, John C.	1C	,,
Mackinnon, Wm.	2C	London
Marshall, W. F.	2C	,,
McCuaig Duncan	2C	Glasgow
McLaren, John S.	2C	,,
McTaminey, L.	1C	,,
Meston, W. H.	2C	London
Milne, Wm.	2C	Glasgow
Oakey, W. E.	2C	Cardiff
Pugsley, James	2C	,,
Taylorson, P. F.	2C	Glasgow
Whelan, Allan	1C	London
Young, John	1C	Glasgow

January 12th, 1889.

Arscott, L. W.	2C	Cardiff
Brown, John	1C	Liverpool
Carr, Ernest, E.	1C	London
Cowan, James	2C	Glasgow
Crawford, Dvid.	1C	London
Creak, Thomas	2C	Leith
Dean, Wm. R.	1C	Liverpool
Drakeford, R. E.	2C	,,
Dunn, Wm.	2C	Glasgow
Eames, Robt. H.	1C	London
Frommurze, S.	2C	Liverpool
Gibb, David	2C	Leith
Gibson, Thomas	2C	Glasgow
Green, William	1C	Liverpool
Hamilton, Gavin	2C	Glasgow
Hulme, David.	1C	London
Ivol, James	1C	Glasgow
Kendall, Thos.	1C	Liverpool
Lang, Joseph	2C	,,
Leetham, Albert	2C	Hull
Lindqvist, S. P.	2C	Leith
McLeod, Angus	2C	,,
Parker, Jn. Hy.	1C	,,
Quillish, Wm.	1C	Liverpool
Scott, Walker J.	1C	London
Sillars, Neill	2C	Leith
Stevenson, John	2C	Glasgow
Summers, Wm.	1C	Liverpool
Waight, John.	1C	London

January 19th, 1889.

Anderson, J. T.	2C	N. Shields
Astles, John	2C	Liverpool
Bade, Carl	2C	W. Htl'p'l
Bond, John	1C	Liverpool
Bowes, Alfred.	1C	W. Htl'p'l
Buchanan, D.	2C	Liverpool
Cox, Ed. John	2C	W. Htl'p'l
Forbes, Alex.,	C2	Aberdeen
Macdonald, G.	1C	,,
Oliver, Thos.	2C	W. Htl'p'l
Pullin, Fred. J.	1C	London
Ramsay, A. B.	1C	Dundee
Ryan, Timothy	1C	Liverpool
Ryles, Aaron E.	2C	N. Shields
Smith, Wm.	2C	Aberdeen
Sparks, Wm. B.	2C	Liverpool
Still, Jas. Gray	2C	Aberdeen
Thornton, J. P.	1C	N. Shields
Watkins, Henry	2C	London
Watson, Jacob	1C	N. Shields

The Marine Engineer.

LONDON, MARCH 1, 1889.

THOUGH it would appear but selfish, we still must say that we are far from disappointed to learn that we do not stand alone in serious accidents to the new large ordnance in our Navy. We learn from *Le Génie Civil*, that in December last, one of the 13·4 in. large guns on the *Admiral Duperré*, blew its breech out during the practice in firing in squadron in the Juan Gulf. This disaster was of so serious a character as to cause the death of the six men who worked the gun. This gun was of the 1875 model. The guns of this model are of cast steel, hooped and tubed with steel, and was the result of experiments made during the preceding period on the tubing of cast guns, and with slow burning powder of large grain. The tube is of forged steel, and tempered in oil, and the body of the gun is formed of two pieces of cast steel united together. It was impossible to obtain a block of a single piece large enough to form the body of the gun while presenting any guarantee for soundness of structure. Even when reduced to two blocks, the security is by no means absolute. The body of the gun acts as a nut to the screw of the breech, and if there is in the first threads of the screw some hardly apparent fault, it is able to dislodge the breech. It is probable that the steel of the body of the gun was not safe at the back of the tube, and it is this fault which caused the breech to yield. The breech was wrenched in a transverse direction, passing the first threads of the nut of the body of the gun, and was projected with its breech bolt still held firmly. The accident can hardly be attributable to an excessive charge of powder, since the tube, which was only held by its friction plate, has been found to have been displaced towards the breech by the action of firing. It is now questioned whether the substitution of steel castings in place of an older design of cast iron placed between the rows of hoops of steel and steel tubes has not been a mistake. This would seem to us a somewhat paradoxical conclusion, and indicating rather an ignorance on the part of our French neighbours in the most trustworthy manipulation of cast steel. The Krupp gun, on large scales, seems also, in the hands of various governments, to have met with many accidents, a considerable number having burst either in testing, or in position, in the hands of the Russian Government.

MR. HENRY WILSON, of the Phœnix Works, Stockton, has given some interesting information as to his experience in the adaptation and use of forced draught, not only with regard to marine and other boilers, but with regard to many other industrial processes, such as to malting, the drying and seasoning of timber, the extraction of moisture from grain and fabrics, &c. About some two and a half years ago, orders for the application of forced draught to steamers fell into his hands, and the results have been in most cases very satisfactory. A London vessel had her speed increased between two and three knots with the same consumption of fuel, and in the case of some land boilers, the saving of fuel on four boilers was recorded at £8 a week, but in other cases a much less favourable result followed. This accords, we believe, with the average experience of other engineers applying forced draught. The success following upon the application of forced draught depends almost entirely on the specific circumstances of the boiler, and chiefly where there is a deficient natural draught. In marine boilers where the height of the chimney was limited, and where the furnaces that were in the wings had difficulty in drawing such a supply of air as would suffice for the proper combustion of the fuel with which they were fed, forced draught showed to great advantage. Mr. Wilson is of opinion that in the ordinary marine boiler the weight of air requisite for the perfect combustion of the coal in the furnace is, in many cases, much greater than can be obtained by the ordinary draught obtained from a marine funnel. Mr. Wilson, however, does not seem to believe, with the same faith as others, in the heating of the forced blast, as he now makes it his practice to supply the forced draught cold to the fire, under the impression that the fire burns better under the influence of perfectly cold air, and he adduces as a reason for this opinion the brightness of a domestic fire on a frosty day, as compared with its comparative dulness on a hot day. In this argument we must quite differ with Mr. Wilson. The brightness of a domestic fire, which we must remember is fired essentially by natural draught, depends upon the difference of temperature of the air as it passes through the fire and the external temperature of the weather; hence, cold weather and a light condition of the atmosphere, such as frosty weather, is conducive to a good natural draught, whilst warm and muggy weather tends to the opposite effect. In an air pump, a pump barrel of strong plate glass, having a piston with elastic packing, is

strongly recommended as virtually having no friction and no necessity for lubrication. A pressure of 8 lb. on the square inch is readily obtainable from this apparatus. Mr. Wilson does not advocate closed stokeholds or ashpits with high pressures of air, as such systems but generated a concentrated heat almost white, which in a boiler furnace is thought very injurious, and better substituted by a more moderate increase of temperature. From the general mass of experience in the subject of forced draught there is but little doubt that a judiciously applied artificial draught to marine boilers ought to effect an economy of about 15 per cent. in coal, marine funnels inducing but a very indifferent draught. There is, however, much liability to disappointment, while the subject is so far in its infancy at present, from a liability of such new application running to excess in the first instance, or from misapprehension of the special necessities and conditions of each case, which may be very different to each other.

THERE is probably still much to be done in the improvement and perfecting of the mechanical details of the steamers which we are apt to think are rapidly approaching perfection. We noticed the other day what appears to be a departure of some novelty and a new arrangement of steering gear. This is the invention of a Mr. J. H. Harrison, and consists of an apparent improvement on the Thorneycroft system, where two rudders act from two centres on either side of the propeller. Harrison's steering gear, however, consists of two rudders attached by a yoke with a common centre. Thus the two rudders move bodily about an ordinary tiller axis. The form of the rudders is such that, as the rudder is put hard over, one blade passes in front of the propeller whilst the other passes partially behind it. Thus, in addition to the effect of the outer faces of the rudder upon the general mass of water through which the vessel is moving, the propeller being enclosed between the two blades, contributes immensely to the prompt and immediate movement of the vessel, in obedience to the helm, by the actual diversion of the whole stream of water from the propeller, so as to react upon the stern of the vessel, to turn it in the required direction. The result is, that without movement of the vessel with regard to the surrounding water, immediately the propeller is turned, the whole power evolved from the engines is exerted in turning the vessel at once, even before "way" is on her. This new arrangement may also be considered to be excessively advantageous in the fact that the screw is protected to a large extent from floating *débris*, whilst its design allows it to act as a shield against bullets. The manœuvering power is still sufficiently retained when the engines are reversed. A 40-ft. launch to which the rudder has been applied, proves that the boat can be made to turn continuous circles, under 60 ft. in diameter, with the engines running full speed ahead. This promises to be a very considerable advance in steering mechanism.

INSTITUTE OF MARINE ENGINEERS.

A PUBLIC meeting of engineers and others interested in the formation of the above was held at Stratford on Tuesday evening, February 12th. Mr. A. Beldam occupied the chair, and was supported by Messrs. Lester, W. J. Craig, A. W. Robertson, J. Neely (Solicitor), J. W. Domoney (Hon. Treasurer), and Jas. Adamson (Hon. Secretary). The Chairman introduced the business of the evening in a brief speech, pointing out the need that exists for such an Institute as was proposed, the desirability of having rooms easy of access from the Docks for the accommodation of engineers, and the want of an association conducted on a good sound basis. As to the first point, the duties devolving upon Marine Engineers of the present day are such, that it is only by dint of hard work, close attention and study, that they can fit themselves for even a junior position in the engine-room of the modern steamship. The increased boiler-pressure and speed, with guarded economy of fuel, the special machinery fitted for the greater comfort of passengers, as well as for carrying, loading and discharging of cargoes, involve the exercise of all the faculties of a well-trained practical engineer, with almost superhuman experience to aid him in emergencies which may arise at any moment.

Under the wing of such an Institute, engineers could meet to discuss and consider the various specialities and experiences which come under their notice, and thus benefit themselves and do better justice to the valuable machinery entrusted to their care. As to the second point, there are many, especially the juniors, whose ship is their home while in port, and who have thus no definite place to spend their evenings, for these and all, the Institute at once opens up accommodation where an evening may be spent pleasantly and profitably in the reading room, library, or such amusements as the Council of the Institute may consider advisable, where, indeed, social intercourse of an elevating kind may be indulged in. As to the third point, it would remain with the audience to judge after hearing the statement to be made by the Secretary, who had been mainly instrumental in bringing forth the child, so to speak, in its present defined form, whether or not, the foundation was sound and good. In conclusion, the Chairman expressed his hope and confidence that the Institute would become a power, not only in London, but throughout the world.

The Honorary Secretary then addressed the meeting, and stated that Mr. H. M. Rait had conveyed to him by letter his warmest wishes for the success of the Institute, and his regret that an engagement prevented his presence at the meeting.

Since the date of the circular convening this meeting, and setting forth the aims and objects of the proposed Institute, the Organizing Committee, which had been increased in numbers from time to time as the need arose, had met at least once a week in order to discuss the various questions which arose in connection with the preliminary stages of setting the association in shape. The question of shares was known, even at the time of writing out the circular, to be hedged by difficulties as to liability of the members and shareholders, and so, acting on legal advice, the scheme of raising money by means of shares was abandoned, and it was now decided that all the funds would be devoted towards the main objects of the Institute, and no member shall receive any monetary benefit from the Institute, either in the form of Dividend, Commission, or otherwise.

The benefits to be derived from connection with the Institute are more lasting and more valuable than gold which perishes.

In order to concentrate the labour of the Committee and systematise the work, the General Committee was divided into five sub-committees, viz.:—

1. "Premises Committee" (Mr. Greer, convener), whose work was to consider suitable locality, suitable premises, and suitable rent or cost, &c. After considerable labour it was decided that meantime the most convenient locality was Stratford, and an arrangement was made with Mr. Hay to open a reading-room in the Langthorn, Broadway, Stratford, each evening, from five till ten p.m., where members could find a comfortable room and various technical and other papers and books.

2. "Finance Committee" (Mr. Coubro, convener), whose work was to consider ways and means of raising money and spending it to the best advantage, also the most advisable and convenient form of Registration to protect members and limit their monetary responsibility.

3. "Constitution and Bye-laws" (Mr. J. H. Thompson, convener), whose work was to consider classification of membership, Rules and regulations for conducting the affairs of the Institute, and questions of kindred nature.

4. "Library and Reading-room" (Mr. Hawthorne, convener), whose work was to consider the books, periodicals and magazines to be obtained, and draw up a code of Bye-laws for the Reading-room and Library. In connection with this department the Secretary stated he was Treasurer of a fund called the Campbell Memorial Fund, subscribed by the engineers of the several steamers of which the late Malcolm Campbell was superintendent engineer. With this fund it was proposed to found a library under trustees, to be called the "Campbell Memorial Library." To this proposal Mrs. Campbell and the majority of the subscribers have cordially agreed. Mr. MacFarlane Gray and several other gentlemen have offered volumes to the Library, and manifested great interest in the whole scheme.

5. "Papers and Discussions" (Messrs. Maginnis and J. R. Ruthven, conveners), whose work was to arrange times and places for discussions, subjects for discussion, and reading of original papers. After the Finance and Constitution Committees had so far methodised their several inquiries, they were united under the convenership of the Secretary, and after several meetings with the solicitor, the Articles were framed to comply with the regulations of Section 23 of the Companies Act of 1867, and communications having passed between Mr. Neely, solicitor, on behalf of the Committee, and the Board of Trade, the latter has given a favourable reply as to granting a License of Registration.

In order to give those present an opportunity of judging the case for themselves, Mr. Neely, solicitor, would read over the Memorandum of Association and Articles of Constitution, so far as the latter dealt with what was mainly of interest to members, or intending members. Before concluding, Mr. Adamson touched upon the necessity which would be patent to all for an Institute of Marine Engineers, and expressed opinion that the Institute now formed would become a force for good, and at least a rival, if it did not overtop in influence, the well-known Institutes of Mechanical Engineers and Naval Architects.

Mr. Neely, solicitor, then submitted the Memorandum of Association, and explained that by registering the Institute under Section 23 of the Companies Act of 1867, the membership liability was limited, and the liability in their case would be limited to 5s. per member in addition to the subscription, in the event of the association being wound up. The clauses relating to membership and subscriptions were read, showing that all grades and classes had been considered and included by the Committee, both in respect to engineers on sea and land, including apprentices who have served at least three years to the trade or business of engineering, with especial reference to Marine Engineering, as *Members*, those holding first-class Board of Trade Certificates, and have served as chief or second engineer at sea, or Marine Engineers in responsible positions on shore. Entrance fee, £1; annual subscription, £1 1s.

Associate Members.—Those holding second-class Board of Trade Certificates and who have served as officers of a watch at sea for not less than 18 months, or Marine Engineers in some responsible positions on shore. Entrance fee, £1; and annual subscription, 15s. *Honorary Members.*—Gentlemen interested in Marine Engineering.

Associates.—Marine Engineers at sea or on shore, who occupy junior positions. Entrance fee, 15s.; annual subscription, 10s.

Graduates.—Apprentices who have served three years at least, who intend to follow the calling of Marine Engineers: Entrance fee, 10s.: annual subscription, 5s.

The following resolution was proposed by Mr. Lester (Messrs. Lester & Perkins): "I beg to move that this meeting express hearty approval of the work of the Organising Committee to this date, and endorse the views and principles as enunciated in the Memorandum of Association as read by the solicitor, Mr. Neely, and do further express confidence in the Committee by voting unanimously a resolution to the effect that the Articles of Constitution, based upon the Memorandum, be framed by the Committee acting along with the solicitor, so as to meet the requirements of the Board of Trade, as a condition to the granting of a License for the Registration of the Institute of Marine Engineers, under Section 23 of the 'Companies Act, 1867.'"

Mr. Lester, in moving the resolution, expressed his hearty sympathy with the objects of the Committee; although a Naval Architect himself, and inclined naturally to consider his own immediate Society to be of great importance, he felt that the importance of the engineer in connection with shipbuilding was paramount, and even allowing for the enthusiasm of Mr. Adamson in pressing the claims of his own cause, he was inclined to yield the palm to the Engineers, and hoped the Institute would have good support. Mr. Lester gave a brief and interesting *resumé* of the history of shipping during his own personal experience, and concluded by wishing the promoters all success in their laudable undertaking.

Mr. Fish (chief engineer P. & O. Co.), seconded the resolution in a few well-chosen sentences, and assured the Committee of his support. The resolution being put to the meeting, was carried unanimously.

Mr. A. W. Robertson (Engine Works, Custom House), then addressed the meeting, expressing his cordial sympathy and support. He dwelt upon the importance of discussions and detailing experiences for the benefit of the Engineering Community at large, and urged earnestly and forcibly upon all to do their utmost to advance the interests of the Institute, and add to their own and fellow engineers' knowledge of what is useful, or likely to be useful, not only to the Institute, but to the whole community.

Messrs. J. Stewart, W. J. Craig, J. H. Thomson, J. R. Ruthven, White, J. Hawthorne, and J. W. Domoney (Hon. Treas.), also addressed the meeting, which concluded by Mr. Domoney proposing, Mr. J. Hawthorne seconding, a vote of thanks to the Chairman, who replied by a suitable acknowledgment.

THE DEVELOPMENT OF THE "WELL-DECK" CARGO STEAMER.*

By G. W. Sivewright, M.I.N.A.

In tracing the development of raised quarter-deck vessels, better known as "well-deck" steamers, the writer will endeavour to explain to the members of this Institution the reasons why such a class of vessel was introduced, and to point out the many considerations that have arisen from time to time to bring this type to its present design.

Previously to the year 1865 the shipowners of the North-East Coast ports did their carrying trade with "flush deck" steamers, as in Fig. A. As long as these vessels were employed in the deadweight trade no inconvenience was experienced as regards trim, but when homogeneous cargoes were carried of such a density as to completely fill the holds, these vessels trimmed by the head. To prevent this, and to get them into proper trim, it was found necessary to bulkhead off a large portion of the fore-hold, this of course meant the shutting out of cargo, and the curtailing of the earning powers of the vessel.

The more extended use of water ballast suggested the idea of trimming tanks at the ends, but these could only be used when the cargo was of the lightest description. Although this, in one sense, got over the difficulty of trim, yet the filling of these tanks for trimming purposes meant the carrying of a large amount of deadweight upon which no freight was earned.

One of the principal faults in the design was that the cubical capacity of the fore-hold was considerably in excess of the after-hold, this being due in a large degree to the engine and boiler room being placed so far aft. To overcome this objection the

* Read before the North-East Coast Institution of Engineers and Shipbuilders, in Newcastle-on-Tyne, February 11th, 1889.

machinery space was moved further forward; this certainly assisted the loaded trim; but when these vessels were in ballast it was found they had great difficulty in moving from port to port on account of the propeller being so lightly immersed.

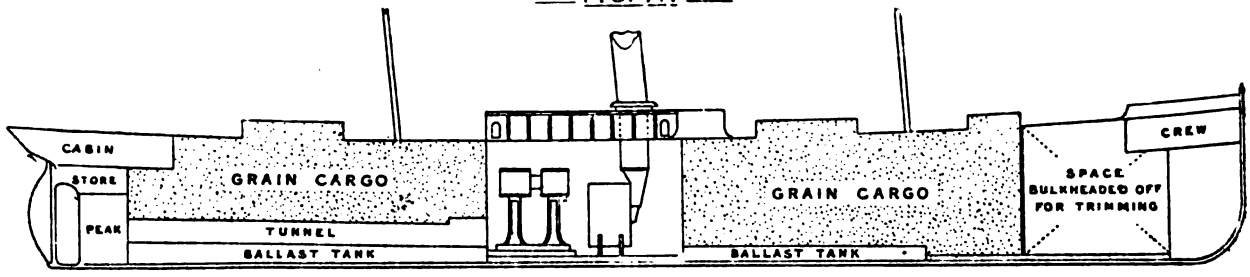
As this type increased in size the second deck was introduced, as shown in Fig. B. There can be no doubt that the additional deck was of use in strengthening the structure; but it was found that it was a source of danger when the vessel was loaded with coal or grain in bulk. It is well-known to shipowners that there is always a certain amount of settling of bulk cargoes, and this is most likely to take place at the underside of decks as shown in Figs. C and D; and should these cargoes be loaded hurriedly or carelessly trimmed this settling develops into a most dangerous feature, for when vessels loaded under these conditions experience heavy weather, the result proves most disastrous, indeed there is good reason to suppose that a large number of this type have been lost through no other cause than the shifting of their cargoes. This intermediate deck, however, is of great service when loading general cargo.

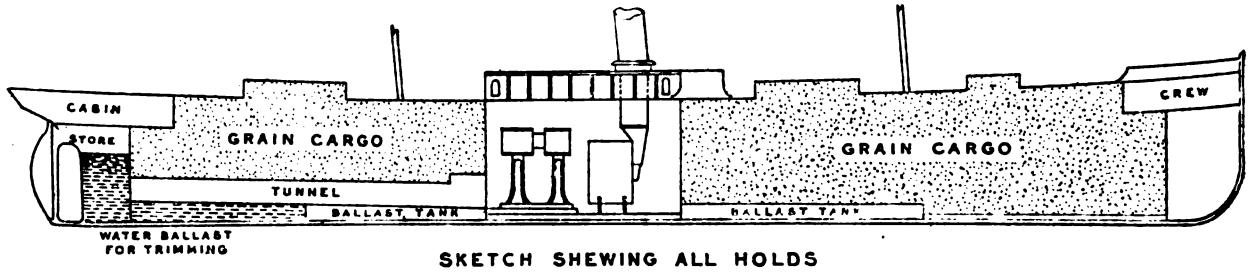
In the "long full poop" steamer, as shown in Fig. E, the objectionable feature of trimming by the head was overcome by carrying a portion of the cargo in the poop; but by trading with these vessels shipowners paid for a large amount of tonnage that gave no pecuniary return, the full benefit of the poop being only obtained when filled with cargo of the lightest description, and when loaded under these conditions the vessels trimmed too much by the stern.

Many of the North-East Coast shipowners found from experience that the carrying of general cargoes represented a very small proportion of the carrying trade of the world, and they were not long in arriving at the conclusion that by using flush or double-deck steamers, in their opinion, they were trading with a class of vessel most unsuitable for their work.

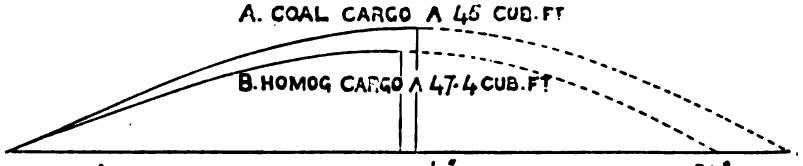
SINGLE DECK VESSELS

— FIG. A. —





SKETCH SHEWING ALL HOLDS FULL, WITH PART OF AFTER TANKS FULL.



CURVE A. MAXIMUM RIGHTING LEVER 10¼" VANISHING STABILITY 54°
B " " 8½ " " 49°
SURPLUS BUOYANCY 26.4%

It was felt that a type of vessel was wanted that would be reasonably safe when loaded with bulk cargoes, and in good sea trim, that is, as near as possible on an even keel, also that they should be well down by the stern when in ballast. To carry out these requirements the "raised quarter-deck" type of vessel was introduced, as shown in Fig. F. By the addition of the raised quarter-deck in this description of steamer the after-hold is made as nearly as possible of the same capacity as the fore-hold, so that when the holds are quite full of cargo the vessel is in good trim. Being single-decked ships—that is, having no intermediate deck—very little trouble is experienced from the shifting of bulk cargoes; but should a portion of such a cargo shift through the vessel meeting with heavy weather, it

becomes a simple matter to trim it into position again.

The curves of stability for this type of steamer, laden respectively with coals and with homogeneous cargo supposed to completely fill the holds, are shown in Fig. G, and it is thought that there can be no possibility of difference of opinion as to these vessels fulfilling all the necessary requirements in regard to stability, their righting levers and the general character of their curves are quite equal to what is deemed necessary by the authorities and experts on this special branch of the subject.

Some of the earliest "well-deck" vessels were built at the Hartlepools, where, to date, upwards of 350 such vessels, having an aggregate tonnage of over half-a-million tons, have been added to the Mercantile Marine, and the writer thinks it will be a matter of interest in stating that during the past four years all the vessels built at the Hartlepools for local owners have been exclusively of this type.

The general behaviour of these vessels at sea is all that can be desired, and having extended their area of trading and the length of their voyages, a corresponding increase in the dimensions of these vessels has taken place. To make them more suitable for Atlantic trading, the erections have been increased in strength and the alleyways through the bridge dispensed with. The addition of the top gallant forecastle is a further improvement. These structures being made nearly as possible watertight, the buoyancy or lifting power of the vessel in a heavy seaway is correspondingly increased.

Suitable as this class of vessel is for carrying cargoes of ordinary description, such as grain and coal, yet when carrying large ore cargoes evident signs of straining at the top sides and bilges were noticeable. The straining of the structure being more pronounced when this kind of cargo was stowed amidships, as shown in Fig. F. The substitution of iron for wood decks, and the thickening of the upper shell plating reduced the top straining, and the introduction of the continuous bottom, on the cellular principle, with the addition of web frames and intercostals in holds and machinery space, remedied the bilge straining.

Satisfied as local shipowners were with the results of the all-round trading of these vessels, yet a very critical time in the history of this type took place in the year 1880, and this was due to the manner in which the Board of Trade detained these vessels for alleged overloading. It was a difficult matter for shipowners to account for this action, for, according to the statistics prepared by local insurance clubs, the loss of life from the foundering of this type compared very favourably with all other classes of vessels. The practice followed by owners in loading was to immerse these vessels to a freeboard representing about one-tenth of the depth moulded, but according to the rules formulated by the Board of Trade very much more freeboard was required. Naturally, shipowners resented the action of these authorities when they realised that if the Board of Trade freeboard was to become law it meant a large pecuniary loss to themselves, and would lead eventually to the condemning of a very useful class of cargo boats. Matters became so strained with these authorities that decided action had to be taken on the part of the shipowners, this action resulting in the appointmnet of the Load Line Committee, and the shipowners in giving evidence before this Committee were able to prove that the "well-deck" type of steamer was one of the safest class of cargo boats in use. In further proof that their contentions were correct, the writer may state that since Lloyd's Register have taken over the control of freehold assignments, that this body are allowing these vessels at this day to sail at their old free-

DOUBLE DECKED VESSEL.

FIG. B.

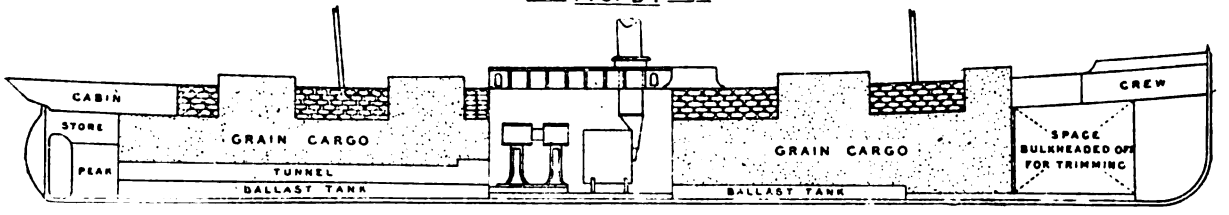


FIG. C.

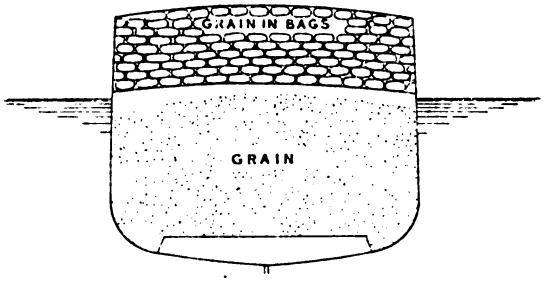
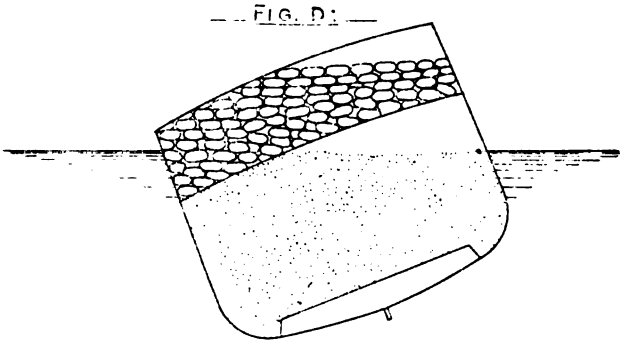


FIG. D.



board provided a slight addition be made to the strengthening of the bridge front, as shown in Fig. H.

During the time that this freeboard dispute between the Board of Trade and the shipowners occupied so much attention, another type of "well-deck" steamer was introduced, and this is known as the "long" or "extended bridge" type, as shown in Fig I. There can be no doubt that the favourable freeboard granted to these vessels is one of the reasons of this design meeting so much favour, and by the shortening of the fore well the principal objection made by the Board of Trade to the old type is overcome. The lengthening of the bridge is of service when carrying light cargoes, and by not quite closing in the fore well a certain amount of tonnage is saved when these vessels are trading with dead-weight cargoes. By comparing the curves of stability it will be seen that the length of the righting levers is not so great as in the old type, yet the range is ample, thus giving a good margin of safety under all conditions, as shown in Fig. J.

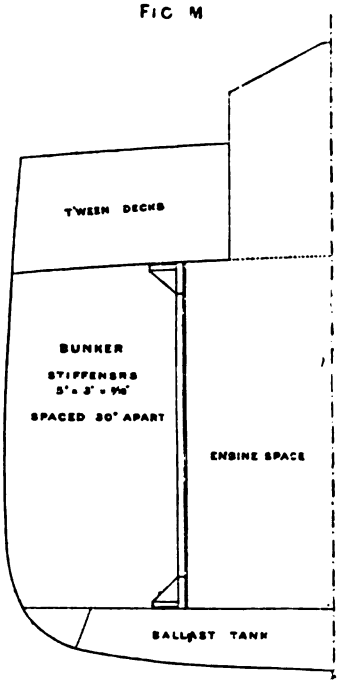
The general expansion of trade in India led to the Government purchasing large quantities of material for the making of railways, bridges, and other iron structures, most of this material is shipped from the North and the cargo steamers owned on this coast carry the largest proportion of this material to its destination. In the earlier cargoes carried it was divided into about equal weights into each hold, but it was found when these vessels were loaded in this manner they laboured very

much at sea on account of this heavy material being stowed so low, and as the result of experience these cargoes are now stowed more amidships until we have them carried as shown in Fig. K.

In checking over the load draughts of several vessels loaded with railway iron, the owners had found that the depth moulded to the disc did not agree with the draught at each end of the ship, and to investigate the matter, the writer made a number of sighting tests along the deck when the vessels were empty and when loaded, and found in a number of the earlier types of cargo boats that a certain amount of sagging took place amidships, and this sagging was verified by the draughts taken at each end and amidships.

The stowing of these cargoes in the manner described and as shown in Fig. K, may possibly have a tendency to make the vessels more sea-kindly, but at the same time there can be no difference of opinion that to carry such large weights amidships would subject vessels to heavy strains. It will be readily seen by comparing the displacement curve with the curve of weight, viz., that showing the disposition of the iron cargo and other weights, as shown in Fig. L, that it is almost certain that sagging would take place over the amidship portion of the vessel.

FIG M



Another feature to be considered is the lying of vessels aground when taking in or discharging cargoes of the heaviest description. It will be well known to many of the members present that there is a clause in charter-parties which states that vessels are "always to load and discharge afloat." Practically this clause is now a dead letter, for the reason that many steamers of large dimensions can only take in a portion of their cargo in dock, on account of the want of water over the sills, and they move into the river to complete the loading, thus taking the ground every tide.

Shipbuilders might reasonably complain that it was never intended to stow such heavy iron cargoes in the manner described, and that it is not fair treatment of vessels of large dimensions to load them whilst lying aground; but, seeing that a considerable amount of trading can only be done under these conditions, it is for the shipbuilder to design vessels so that they will withstand strains of any unusual nature.

The firm of Messrs. Edward Withy & Co., with whom the writer has the honour to be connected, determined, in building their vessels, to make it their universal practice that the design should be on the web frame and cellular bottom principle. This decision was arrived at as the result of a series of calculations of the hogging, sagging, and racking strains likely to occur in cargo vessels under all conditons at sea, and which by actual results have been verified.

To increase the longitudinal strength of the structure, the introduction of longer plates has been decided upon, and for some time past plates have been used from 20 to 30 ft. in length, thus considerably reducing the breaking or straining points of the shell plating and other vital parts of the vessel. To further increase and assist the longitudinal stiffening and general structural arrangement, the fore and after grain divisions in the holds and 'tween decks are made of iron, well stiffened by angles, and also, by the substitution of iron for wood bulkheads in the holds, is of use in giving increased transverse strength to the structure. Seeing that a considerable amount of deck-straining at the butts had been noticed from time to time in the vicinity of the engine and boiler space, to assist in reducing this, larger through beams were fitted, and these being plated over and also well supported by stanchions have been found to give increased strength; and lately the writer is stiffening the lower bunker sides with extra large-sized angle iron so closely spaced that these bunker sides form a strong vertical support, instead of being, as in the past, merely receptacles for coals, for which sketch see Fig. M.

But probably one of the most important additions to the strength of the structure was the making of the bridge and quarter-deck side plating of the same thickness as the main shell plating of the vessel. Signs of movement at the top side butts had been noticed when vessels were loaded with railway iron in 'tween decks, as shown in Fig. K, and to back up this plating more effectually Z frame bars rolled in solid section were introduced. By this arrangement the Z frame (which represents a frame and reverse bar) is carried to the top of the structure on every frame, instead of to the lower and main deck stringer, as hitherto in cargo boats. Before adopting this frame of solid Z section, the writer made a number of exhaustive percussion tests, and found that the Z bar is very much superior in strength to the riveted frame and reverse bar, the riveted bars being destroyed at the sixth blow, and the Z bar being only fractured at the fifty-third blow; this superiority of the Z section being further verified by a number of tensile and bending tests made by Messrs. Kirkcaldy & Co., of London.

To show the large increase of iron or steel in the construction of vessels, in the year 1870 there was 14 per cent. of wood used in the structure, and in vessels built during the last year there was only 7 per cent. of wood used. The gain in strength to the structure by the substitution of so much iron or steel for wood can be readily understood.

The design of the raised quarter-deck type of vessel has been so carefully studied out and improved during the last 10 years that, from actual sea experience, this type has proved to be one of the strongest class of cargo boats that is now being built; and it is a matter of congratulation when we consider that vessels of this class can be built to carry iron cargoes of over 4,000 tons weight, and to be able to do this work without straining the structure or in any way endangering the safety of the vessel at sea.

In presenting this paper to the members of this Institution, the writer trusts, where so many of its members are so closely connected with the interests of shipbuilding and shipowning, such an expression of opinion may take place that further improvements may be suggested in this useful class of cargo boat, and at the same time he regrets the brief manner in which so many important points have had necessarily to be dealt with in this paper.

TRIAL TRIP OF THE P. AND O. STEAMER "ORIENTAL."

ON February 1st the Peninsular and Oriental Steamship Navigation Co.'s steamer *Oriental*, built and engined by Messrs. Caird & Co., Greenock, went on her trial trip. This steamer, which has been built and engined under the superintendence of Mr. H. J. Taylor and Mr. J. Pettigrew, is of the following dimensions:—Length, 410 ft.; breadth, 48 ft.; depth, 36 ft., having a gross tonnage of about 5,500 tons. Her general outline is graceful, which is contributed to materially by her beautiful elliptical stern and straight stem. She has eight watertight bulkheads, all extending up to the spar deck. The deck-houses, which are double-topped, are built of steel, with

THE DEVELOPMENT OF THE "WELL-DECK" CARGO STEAMER.

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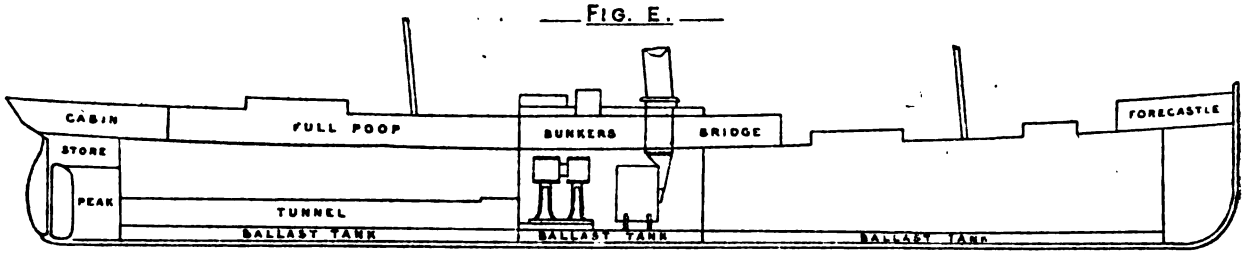
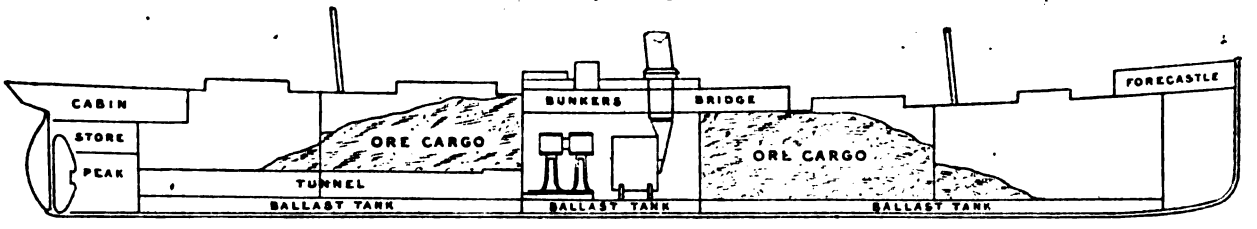
LONG FULL POOP VESSEL.

FIG. E.



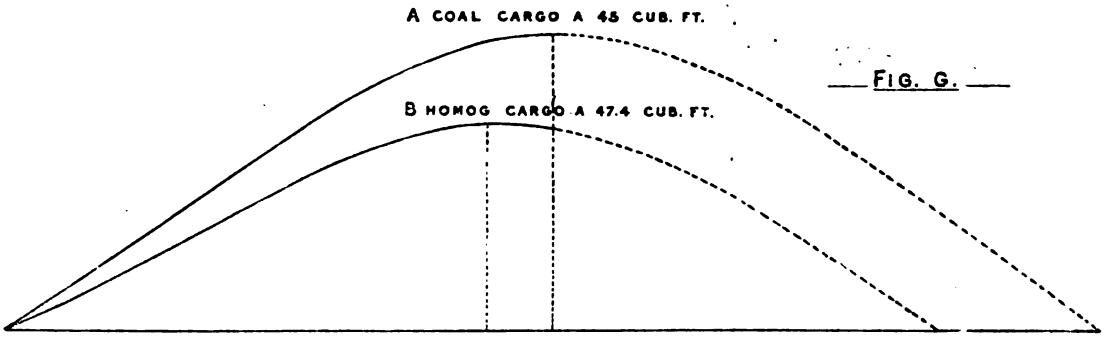
RAISED QUARTER DECK, & BRIDGE COVERING MIDSHIPS.

FIG. F.



CURVES OF STABILITY.

FIG. G.



CURVE A MAXIMUM RIGHTING LEVER 15½° VANISHING STABILITY 84½°
B " 10 " " 74
SURPLUS BUOYANCY 32·6%.

For description see pages 404 *&* 405.

16-in. brass scuttles of an improved type. Accommodation is provided for 130 first-class and 32 second-class passengers. The former are principally housed on the spar deck in state-rooms. The general design and treatment of the dining-hall and saloons are carried out in a thoroughly artistic manner. The hall has a beautifully-panelled oak dado about 4½ ft. high, above which is a Tynecastle tapestry of Californian gray ground, with rich gold relief, embossed in pleasing patterns. The frames of the seats are all made reversible, being caned on one side and upholstered on the other. The advantage of this arrangement is that the caned seats can be used in the hot climate and the upholstered seats in the colder regions. The smoking-room, which is 22 ft. square, is situated aft, and is fitted with large skylights. A nice oak figured dado, surmounted by mural decorations, make the smoking-room a comfortable divan. In the music saloon the oak dado and Tynecastle tapestry wall hangings are luxurious. The sofas and settees are richly upholstered in *broché* silk velvet, the windows having silk curtains in claret and gold hanging from silver mounts. Not only have the first-class passengers received due attention for their comfort, but the second-class passengers of the Peninsular and Oriental Co. have, during the last few years, had no inconsiderable thought bestowed upon them. Their quarters in this vessel, which are situated forward, certainly leave nothing to be desired. The captain's cabin is well appointed and comfortably furnished, and has a commanding position. The same applies to the officers' cabins, which are situated alongside the engine and boiler casings. Skead sky-lights run along the entire length of the boiler casings, giving unusual light and ventilation to the main deck. There is an installation of electric light, incandescent lamps being in every room. The vessel is fitted with refrigerating chambers and engines; fresh water tanks holding about 30,000 gallons. The engines are on the inverted, direct-acting, compound, triple-expansion principle, indicating about 5,000 H.P., with a very moderate consumption of coal. The steam steering-gear has been manufactured by Messrs. Muir & Caldwell, Glasgow, and is of most modern type. In addition to this there is, of course, hand steering-gear, consisting of two wheels 8 ft. in diameter. There is an auxiliary rudder for use in going through the Suez Canal, to make the ship answer the helm quicker. The cargo is to be worked by hydraulic gear by Lord Armstrong's firm. The spar deck is strengthened for a gun platform, in accordance with Admiralty requirements, as in case of war many of this company's vessels are converted into armed cruisers.

The *Oriental* left the Tail of the Bank about half-past 11 o'clock and proceeded to Wemyss Bay for the purpose of running the measured mile, the average speed attained being over 16 knots.

THE LAUNCH OF THE "LAO-KAY."

THREE years ago Haiphong consisted of a single street, the rue Chinoise, narrow, winding and broken, with a few straw huts, and one or two brick houses scattered about the neighbourhood.

To-day it is a large town of broad, well-built streets, lined with comfortable and elegant houses, and consisting of a European and a Chinese quarter. Important commercial houses have gradually been established, and while Messrs. Daniel & Chaumont have finished the flying-bridges of the docks, Messrs. Marty & D'Abbadie have entirely constructed a vessel intended for the navigation of the upper Red River.

Sunday morning was a holiday in the offices of the "Services des Correspondances fluviales" on the Cua-Cam. The *Lao-Kay* was to be launched; and the fact that, although the naval workshops had already put together and launched steam launches and gunboats sent from France, with their different parts already numbered, this was the first time that a vessel had been entirely constructed on the spot in Tonkin, made the event all the more important.

The *Lao-Kay* is a single-paddle steam launch, somewhat resembling the flat gunboats of the navy, but having a tapering bow to resist the currents of the upper part of the river. She is 29 mètres long, or 33 mètres including the paddle, 6 mètres 40 cent. broad, and has a hold 1 mètre 75 cent. deep. The horizontal engine directly working the paddle is of 12 H.P.; the boiler, of proof steel at 12 kilos., was made in the workshops, the diameter of the cylinders is 26 centimètres, and the piston stroke is 92 centimètres. The *Lao-Kay* will have a draught of about 38 centimètres, and when loaded to her utmost capacity, it will not exceed 75 centimètres. On the deck are placed the engine and the boiler, a spar deck covers almost the whole of the surface, and on it will be placed the saloon and cabins, a sufficiently large space being left for promenading. In conclusion we may say that the *Lao-Kay* has been constructed according to the plans of M. Jack, chief engineer of the workshops, who has superintended the work.

At ten o'clock guests and spectators began to arrive in great numbers, among those present being Messrs. de Pincé, resident of Haiphong; Thureau, vice-resident, and president of the Court of Justice; Pessoneaux, commanding the 14th Bat.; Le Bourgeois, naval commander of the station; Jaouin, second naval engineer and director of the naval workshops at Haiphong; Lieut. Garnaud; M. Boucard, assistant commissary, and Madame Boucard; M. and Madame Mouillard; M. Gallay, surgeon-major in the navy, and Madame Gallay; M. and Madame Oberg; M. Eck, harbour director, and Madame Eck; Messrs. Boyer, commanding the artillery at Haiphong; Terrier, assistant commissary; Huteau, manager of the Indo-Chinese Bank; Fellonneau, agent of the "Service des Correspondances fluviales;" H. Delmas; Candau, vice-president of the Chamber of Commerce; Roze; Raffier-Dufour; Vincens; Salabelle, chief custom-house officer; Leroy-Cahors; Causse; Croizade; Destourmieux, chief mechanician; Fontaine, du Cuer de Cogolin, of the *Courrier d'Haiphong*, &c., &c. Busy Chinese workmen were moving about round the boat and on the deck and spar deck. Madame Boucard, the godmother of the *Lao-Kay*, appeared, with M. Le Bourgeois, the godfather, on a platform behind the boat, and prepared to christen it by sprinkling it with champagne.

But the *Lao-Kay* is very light, and its own weight is not sufficient to start it, so a cable is thrown aboard the *Antoinette*, which moves off and stretches the rope till it seems ready to break, and the *Lao-Kay* enters the water, making a wide track. Amid loud applause the *Lao-Kay* is saluted at four yards from the shore by the deafening whistle of the *Licorne* and the siren of the *Tigre*, while the Chinese workmen on the rocks begin discharging fireworks of various kinds.

TRIALS OF THE NEW STEAMER "ALFONSO XIII."

ON Monday, the 28th January, the trials of the *Alfonso XIII.*, built for the Compania Trasatlantica by Messrs. William Denny & Bros., were completed at a late hour. These trials have been of the most searching description, and have lasted for an entire week, beginning on Monday, the 21st, with progressive trials. The maximum of speed then attained as a mean on the measured mile was 17.3 knots, the vessel having on board at that time half her guaranteed dead-weight. Subsequently two six-hours' trials were made, one with natural draught, when the speed registered was at the rate of 16.8 per hour, the guaranteed speed being at the rate of 16½ per hour. On Monday a six-hours' trial was also made with force draught when the speed registered was 17.3 knots. The revolutions, which were practically constant throughout the whole trial, would have given in fine weather a speed of not less than 17½ knots. The result was considered eminently satisfactory by the representatives of the company, Captain Bayonna and Mr. Thomas Coleman, and the vessel was formally taken over by them. She proceeds on Thursday to Cadiz. During the week full trials were also made of all the auxiliary machinery on board, the whole of which is of the most modern kind, and as it is of special interest we will describe it in detail. We gave already, at the launch of the steamer, a full notice, but for the benefit of our readers who may not have seen it we may recapitulate. The *Alfonso XIII.* is of moulded dimensions, 400 ft. by 46 ft. by 32 ft., constructed to the highest class Veritas, from which society she has also received special mark for buoyancy, insured by numerous watertight bulkheads. This mark is only given to ships in which the watertight sub-division is so arranged that when loaded and with any one of the compartments bilged the ship shall neither sink from insufficient buoyancy nor from want of stability. She is constructed of steel on the cellular double-bottom principle, the pumping arrangements for which are most complete, and arranged to empty any of the tanks in about half-an-hour. She is fitted with a citadel deck, con-

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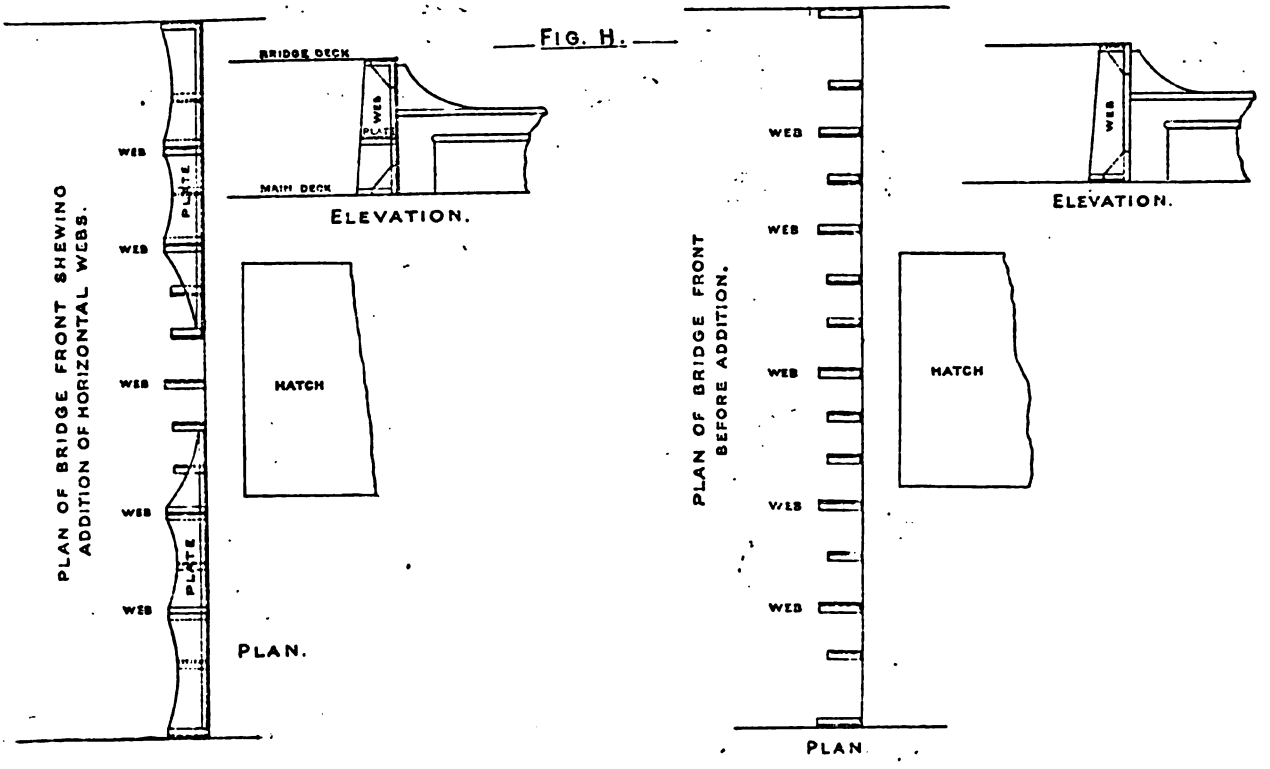
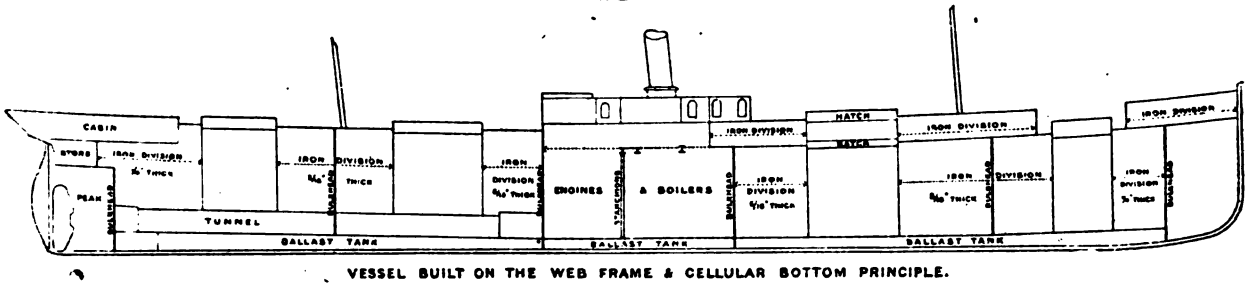
FIG. H.



RAISED QUARTER DECK & LONG EXTENDED BRIDGE.

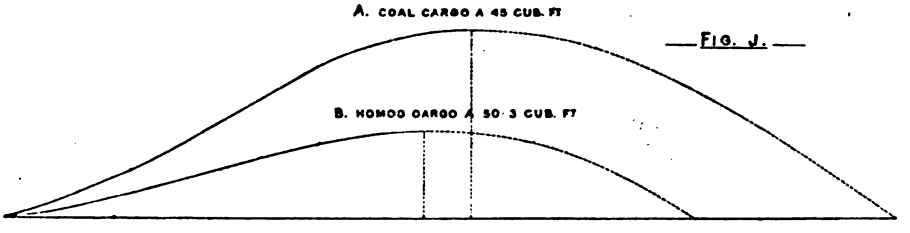
FIG. I.



VESSEL BUILT ON THE WEB FRAME & CELLULAR BOTTOM PRINCIPLE.

CURVES OF STABILITY.

FIG. J.



CURVE A. MAXIMUM RIGHTING LEVER 13½" VANISHING STABILITY 89°
B. " " " 6 " " 69°
SURPLUS BUOYANCY 33·2%

For description see page 405

taining forward the main dining saloon, above this the music-room, the aft part of the citadel being reserved for officers' accommodation, galleys, &c. The passenger accommodation in the upper 'tween decks is of the most superb description, as is customary in the ships of this line. 176 first-class passengers and 56 second-class are allowed for, while 30 men and 12 women will be accommodated in separate compartments in the third-class, and over and above this on the lower deck is fitted accommodation for upwards of 900 troops. Her dining-saloon is on the spar deck, at the forward end of the citadel-house; this, with the music-saloon above, is decorated in the Moorish style, which allows of great elaboration, and has been almost lavishly taken advantage of.

The whole of the ship is lighted by electric light, there being in all 430 lights. The dynamos and engines for driving them are in duplicate, and they are of sufficient power not only to drive the whole of the lights, but also six electric fans supplied by Messrs. King, Brown & Co., for ventilation. These fans, by means of air-pipes, draw the foul air from all the first-class cabins on the 'tween decks, the emigrants' quarters, and also the holds, one of the six fans being fitted in the engine-room as a downcast. These fans are capable, under favourable circumstances, of delivering 200,000 cubic ft. of air per hour. The midship part of the accommodation, within a reasonable distance from the funnel, is ventilated by means of an upcast ventilator in the funnel. In the engine-room is also situated a refrigerating apparatus, supplied by Messrs. Haslam, the chamber being in the aft hold. The whole of the cargo gear is worked by hydraulic power, the pumping engines and hydraulic derricks being supplied by Messrs. Brown Brothers & Co., of Edinburgh. The windlass and steering gear are also worked by hydraulic power, and on the poop deck aft there is a powerful warping winch, and on the citadel deck amidships a hydraulic winch for lifting the boats. She is fitted with eleven ordinary boats and six Chambers's semi-collapsible, unsinkable lifeboats. As she is intended to be used by the Spanish Government as an armed cruiser in case of war, provision is made for eight breech-loading guns, platforms and strengthening being arranged on the deck for this. Her engines and boilers are also surrounded by coal protection in a manner similar to what is required by our own Admiralty. Turning now to her machinery department, her engines are of the three-crank triple-expansion type, with three cylinders, steam being supplied at a pressure of 170 lb. from three double-ended steel tubular boilers. Forced draught appliances on the close ashpit system are fitted, and on trial the general arrangements were found to be most suitable. Two Gwynne centrifugal pumps are used for circulating the water in the condenser, and the boiler feed is pumped by Weir's patent pumps, his feed-heater and distiller being also fitted. Brown's patent hydraulic pumping engines are located in a recess in the engine-room. A small auxiliary pumping engine is fitted for working the steering gear at sea, in order to save working the large compound engines, and to give an opportunity for overhauling the same when required. Brown's hydraulic ash-hoists are fitted in the stokehold for hoisting ashes. The external appearance of the *Alfonso XIII.* is very beautiful; she is fitted with four masts and fully rigged, and the old-fashioned clipper stem gives her a yacht-like appearance, which is sadly lacking in the majority of our mercantile ships. The Compania Trasatlantica and the Spanish Government are to be congratulated on the acquirement of such a ship.

COLLAPSE OF BOILER FURNACES.

THE following is an abstract of a report made by Mr. Parker, Chief Engineer Surveyor to Lloyd's Register, on the collapsing of the furnaces of a boiler in a new steamer:—

The engines and boiler of this vessel, which were surveyed during their construction by the society's surveyors, are in all respects well constructed. The boiler is of the ordinary round multitubular form, 11 ft. 6 in. diameter and 10 ft. long, fitted with two-ribbed furnaces 41 in. diameter and 17-32 in. thick, constructed and stayed, in accordance with the society's rules, to work at a pressure of 160 lb. per square in.

On examination of the boiler it was found that the port furnace had collapsed in two places to the extent of 14 in., and the starboard furnace to 3 in. The whole of the surfaces below the water-line, including tubes, chambers, furnaces, and shell, were covered with small cubical crystals, samples of which have been analysed, and found to consist of nearly pure chloride of sodium (or common salt), there being only traces of other matter.

This is the first case of a furnace of this form collapsing, and, looking to the peculiar appearance of the inside of the boiler, the committee considered that it should be investigated.

The vessel, it appears, is engaged in trading between Garston and Dublin, and had been at sea altogether only 240 hours. The boiler was originally filled with fresh water, and the practice of the man in charge, according to his statement, was to pump the boiler up to what he called "three-quarter glass" when at Garston and Dublin, and when at sea to blow out five inches of water each trip. When at sea the density of the water was measured by a salinometer, and was never found to exceed (in the language used by sea-going engineers), "three-and-a-quarter thirty-twos," "one thirty-two" being equal to five ounces of solid matter to each gallon, or the mean density of sea water. Any extra supply of water required was taken from the sea. This salinometer has been tested and found to be inaccurate, inasmuch as it shows three ounces per gallon short of the true density at a temperature of 200 degrees Fahrenheit, and when the density approaches 16 ounces per gallon, the density at which the engineer acknowledges the boiler was worked, the reading of the salinometer becomes quite unreliable owing to defective weighting, so that it was never known at what density the boiler was being worked. At times the water must have almost reached the point of saturation.

This is a case which shows the safety of furnaces of this form to resist collapse even when neglected until they become highly heated. If they had been plain furnaces the collapse would probably have been accompanied with rupture, and a serious accident might have occurred. In their cold state it would have taken a pressure of from 800 lb. to 850 lb. to have collapsed them, but when hot they collapsed locally at 160 lb., the strengthening ribs keeping the remaining portions of the furnaces in their original position, and preventing rupture taking place.

It is known that deposit takes place more rapidly with high pressures, and, consequently, high temperatures than with low pressures. Theoretically speaking, by the process of converting water into steam, condensing it into water, and again converting it into steam, no loss whatever should take place; but in practice there is a considerable loss from leaky pumps, cylinder glands, cocks, safety valves, condenser tubes, &c., and in an engine kept in good working order, all parts being, practically speaking, tight, and no loss from steam blowing off, &c., I find that for every 1,000 H.P. exerted, one ton of water per day has to be added to the boiler in the form of extra supply. If this water has to be taken from the sea, no less than 2 cwt. of solid matter must be deposited every day, and it can easily be seen how detrimental such treatment must be to boilers engaged on long voyages.

It is considered that all boilers working at high pressure should have some means of making up this loss in the form of fresh water, either by carrying it in the vessel, or evaporating and condensing.

In working marine boilers at the high pressures, now so common, a great amount of ignorance is often displayed by the engineers to whose care they are entrusted, and it may be stated that nearly all cases of collapsed furnaces, leaky tubes, &c., that have come under the notice of the officers of this society since the introduction of the high pressures, have been traceable to improper treatment.

Lloyd's Register of Shipping,
2, White Lion Court, Cornhill, E.C., Jan. 2nd, 1889.

CRESSWELL'S ANTI-FRICTION PACKING.

THE manufacturers of the well-known packing, whose name appears at the head of this notice, have recently sent us a very interesting little book in the shape of one of their revised catalogues. Besides enumerating their various manufactures, the catalogue gives descriptive and suggestive particulars which cannot but prove both useful and interesting to all steam users. Messrs. Cresswell, guided by the experience of a quarter of a century (theirs being one of the first firms in the engine packing field), point out the importance of diminishing friction to a minimum, and the consequent saving of fuel, oil, wear and tear, &c., thereby effected.

The packing made by this firm is well known for its elasticity, self-contained lubricating qualities, power of resisting alike heat and cold, and durability.

At the Naval and Submarine Exhibition, held in London in 1882, samples of Cresswell's packing were submitted to extremes of both heat and cold to demonstrate the unchangeableness of its nature. The packing was submitted to the direct action of a spirit lamp flame without evincing the slightest tendency to run, and in the cold chamber of Piggott & Co.'s and Bell-Coleman's refrigerators, it was taken 40 deg. below zero without altering in the least its lubricating qualities or elasticity.

Briefly we may state that this packing does not char or become hard in the gland, however high the pressure or fast the speed, that it is highly elastic and very durable, and retains its elasticity to the last; that it needs no oil or tallow, a combination of the finest lubricants being thoroughly mixed with the unspun fibre, which is retained until entirely worked up. Further we may state that the packing does not require drawing from the gland, while its uniform and constant supply of lubrication to the rods reduces friction to a minimum.

As regards testimonials, Messrs. Cresswell enjoy the privilege of holding many such from firms who habitually refuse to give such expressions of approval. A special form of this packing is made for hydraulic purposes, and in this form it is in use by, and giving every satisfaction to, amongst others, the Superintendent of the Glasgow Corporation Cleansing Department, and the Superintendent Engineer of the Birmingham Corporation (Interception Department). At the Glasgow Exhibition (where the firm had a stand) the Cresswell Anti-Friction packings were used in the majority, and in the largest engines on show, and were held, all round, in the highest estimation.

In addition to the well-known "Anti-Friction" packing, the firm also manufacture all kinds of engine packings, and every description of asbestos goods, including all types of asbestos ropes, twines, cords, and cloth. From the samples before us, the firm appear to have got over the chief drawback of asbestos when spinning into ropes (*i.e.*, its low tensile strength), and, indeed, all their asbestos productions bear evidence of high excellence, both of materials and manufacture.

We would advise all steam users and consumers of asbestos to write to Messrs. Cresswell (their address being, D. G. Cresswell & Son, Woodbine Street, Barkerend Road, Bradford, Yorkshire) for one of their catalogues; and to any of our readers who desire to make special or new application of asbestos, the firm very kindly offer their assistance and valuable experience gratuitously.

NON-CONDUCTING SILICATE FIBROUS CEMENT.

A NON-CONDUCTING silicate fibrous cement, manufactured by the Liverpool Boiler Cement Company, of 7, Victoria Road, Liverpool, and which gained the highest award at the Liverpool Exhibition of 1886, is now coming into extensive use amongst Liverpool and other shipowners, and appears, from all accounts, to well merit the praise bestowed upon it.

It may interest our readers to know that the award mentioned was the first instance in Great Britain of a non-conducting material being placed before a jury of practical engineers, it having been the practice to allow all such products to be adjudicated upon by a manufacturer's jury. We think the departure was a good one, as obviously the engineers who are using this class of goods are the best judges of its merits.

As its name implies, Silica enters largely into its composition, and the remarkable properties of the Silica clays as heat resisters are too well-known to need reiteration here. The cement as made is very tenacious and extremely elastic, yielding to expansion and contraction in a remarkable degree, and as in process of manufacture it is subjected to a kiln heat, much greater than the temperature that would ever attain on any steam-heated surface, the material is rendered heatproof, and, consequently, will not crumble or char away to powder, as is commonly the case

RAISED QUARTER DECK & LONG EXTENDED BRIDGE,
LOADED WITH RAILWAY MATERIAL.

FIG. K.

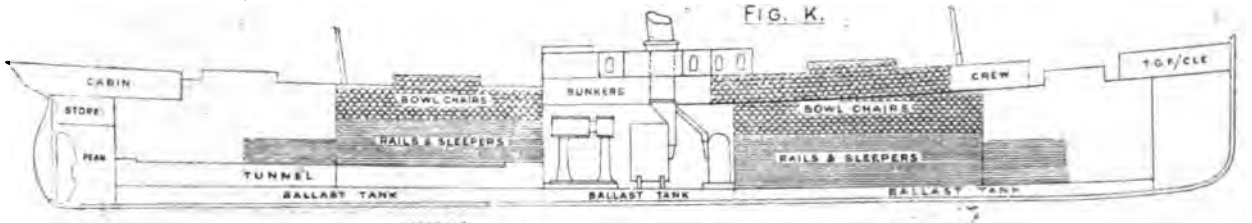
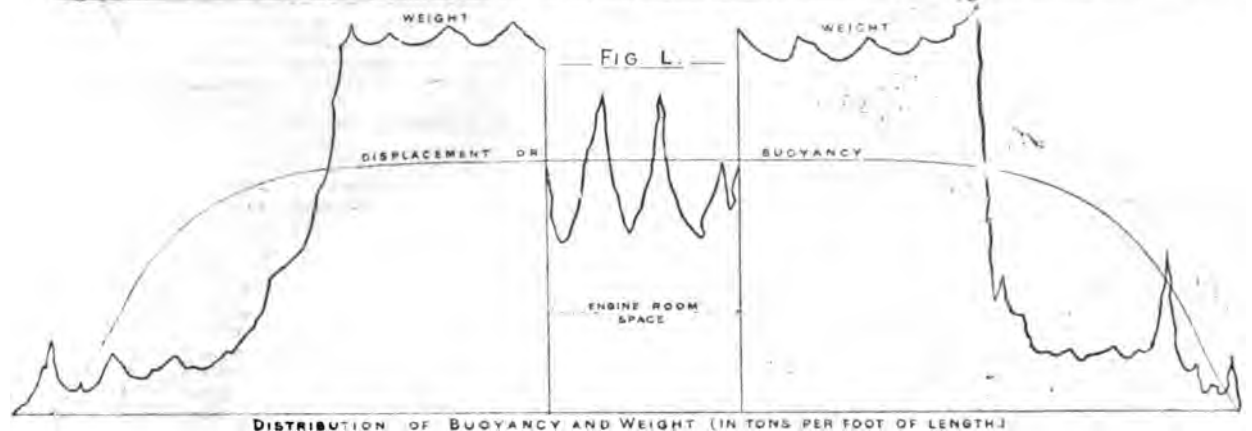


FIG. L.



DISTRIBUTION OF BUOYANCY AND WEIGHT (IN TONS PER FOOT OF LENGTH)
LOADED WITH IRON CARGO.

THE DEVELOPMENT OF THE "WELL-DECK" CARGO STEAMER.—*See pages* 403—406.

with ordinary compositions. Indeed, in this respect, it may be interesting to note that the cement is now extensively used in blast furnaces, being applied to hot blast pipes, which are subject to 1,100 degrees of heat, and in every case it has given perfect satisfaction. Besides being absolutely indestructible by heat and perfectly elastic, the makers claim for it that it is the most adhesive cement in the market.

The time has now *passed* when *anything* would answer for boiler covering, and engineers and shipowners are no longer willing to accept the common clay covering that was usually supplied by the boiler makers when working up to a specification, which usually read, "Boilers to be covered by an approved non-conducting material," leaving it open to the maker to supply anything that he could say was "approved." In these days of high pressures this would not do, and engineers now must specify exactly what they want, and to such we say, without hesitation, give the above named Company a trial.

Messrs. Davis & Co., the proprietors of the Liverpool Boiler Cement Company's cement, are also the proprietors of an elastic steam joint cement which is finding great favour with consulting and superintendent engineers and boiler makers. This cement is both cheaper and superior to red or white lead, and it will make a firm, smooth joint for a screwed patch.

The cement has been extensively used for stopping leaky seams of boilers, and has answered the purpose well, while its application to the leaky seam is quickly and easily made and the results are of a permanent character.

We have before us the names of some of the leading firms in the country who are using this material, including the "Cunard" Steamship Co.; the "National" Steamship Co.; the "Booth" Steamship Co.; the Atlantic Engine Works Co.; the London and North-Western Railway Co., &c., and they all speak highly of it, and testify their opinion by repeat orders.

WRENCH'S OBLIQUE-BLADED PROPELLER.

THE oblique-bladed propeller, shown in our illustration, is the invention of Mr. Wm. G. Wrench, of Glasgow, and is, we understand, the outcome of a course of investigation and experiment extending over a period of twelve years. Though patented several years ago, it did not at first meet with the wide adoption its obvious merits entitled it to. This is due to the circumstance that the great axial length of the propeller, which is one of its essential features, has restricted its applicability to vessels with a sufficiently large screw aperture, or to twin-screw boats. Within the last three or four years, however, it has grown largely in favour, and is now applied to hundreds of vessels.

The "Lotus propeller," as it is called, differs chiefly from all others in the formation of the blade, which has neither the angularly-disposed surface of a screw, nor of a straight fin, but is simply a quadrantal band without any angular twist, the root parts of which roll cylindrically, or nearly so. These parts thus lie approximately parallel to the axis; but the points are radial, and present themselves squarely to the propulsive reaction. The peculiar disposition of the acting surface at the boss neutralises any dispersive tendency, and insures a direct thrust reaction behind the boss. The blade points, although considerably to the rearward of the boss axially, do not trail or follow circumferentially, but lead in the direction in which the propeller rotates ahead. The leading edge of each blade relatively to the vessel's lines invariably forms an obtuse angle, which favours the full admission of the feed water to all its parts. The pitch of the blade, as opposed to the usual improved modification of a screw, decreases from root to point; which ratio may be altered to suit circumstances. Another feature in which these blades differ essentially from all curvated screw blades, is that concentric lines across

their surface decrease in obliquity from root to point.

Mr. Wrench claims that his patent propeller is an efficient medium for increasing the speed of vessels without additional expenditure of fuel or power; that it is a reliable backing propeller, and does not interfere with the action of the rudder, either when going ahead or astern; that vibration and "racing" are reduced to a minimum; and that it has no disturbing action beyond its own diameter; being therefore suitable for boats plying in narrow rivers and canals. It is further claimed that as no symptoms of corrosion have ever been observed on the backs of "Lotus" blades, the forces productive of corrosion, generated by the action of an ordinary screw, are with this propeller almost neutralised. These numerous claims appear to be

fully borne out by the reports of engineers and ship-owners who have adopted the propeller, and by the particulars of a series of measured mile trials made at Skelmorlie, on the Clyde, as detailed below :—

	Steam.	Vac.	Revs.	Time.	Knots.	I.H.P.	Vibration.	Steering.	Backing.
"SWAI LIGH," Steam Towing Vessel - -									
Mean of Four Runs with Common Propeller -	87	—	160	8′-34″	7	—	considerable.	hard.	uncertain & slow
,, ,, ,, Wrench's ,, -	90	—	163	7′-23″	8·12	—	much reduced	easily.	rapid and certain
HOPPER BARGE, No. 5, Clyde Navigation-									
Mean of Two Loaded Runs with Common Propeller	22	22	87	8′-55″	6·72	134	excessive.	hard.	uncertain & slow
,, ,, ,, ,, Wrench's ,,	22	22	83½	8′-1″	7·48	137	abolished.	easily.	rapid and certain
"MUNDURUCUS," Twin-Screw (Steel) -									
Mean of Four Runs with Common Propeller -	80	24	138	7′-22″	8·14	180	moderate.	easily.	freely.
,, ,, ,, ,, Wrench's ,, -	80	24	140	6′-45″	8·89	180	none.	easily.	freely.
"ELPHIN," Steam Yacht - - - -									
Over Long Distance with Common Propeller -	110	—	310	7hs-53′	7·61	—	—	—	—
,, ,, ,, Wrench's ,, -	110	—	232	6hs-55′	8·66	—	—	—	much improved
"ELAGH CASTLE," Cargo Vessel - -									
Mean of Four Runs with Common Propeller -	69½	21	133	7′-0″	8·57	126·1	considerable.	—	—
,, ,, ,, Wrench's ,, -	68½	19	123	6′-37″	9·07	119·5	much reduced	much	improved
"STRATHTAY," Cargo Vessel - - -									
Mean of Four Runs with Common Propeller -	71¼	25	86½	6′-26″	9·30	259·4	considerable.	—	—
,, ,, ,, Wrench's ,, -	72	24	81	6′-7″	9·82	246·1	abolished.	much	improved

N.B.—A second application of this Propeller to several of above vessels, notably "Mercurio" and "Mundurucus" has been attended with still greater improvements. See Testimonials.

Amongst the vessels recently supplied with propellers of this type, we may refer to the twin-screw steamer *Canterbury*, of New Zealand, which, when fitted with ordinary screws, steered very indifferently when going astern, a defect completely remedied by the new propellers; and to the more recent *Banks Peninsula*, a twin-screw steamer, also for the New Zealand service, built by the Grangemouth Dockyard Co. This application clearly demonstrated its advantages in backing and turning. The manœuvering qualities of the propeller were, some months ago, successfully tested on the steam tug *Sunda*, of Singapore, in presence of a number of persons interested in propulsion; among them being several naval officers, who were unanimous in their approval of the propeller for use on ships of war.

WATT ANNIVERSARY CELEBRATIONS.

TWO events which, through stated and regular recurrence, and unfailing *éclat*, have come to be regarded as most fitting means of giving audible expression to that still, but ever-present, homage, which the general heart feels towards the world's benefactor, James Watt, have once more taken place. One is the annual Lecture, delivered under the auspices of the Greenock Philosophical Society, in honour of the birth of the great engineer; the other, the annual Dinner, celebrating the same event, held under the auspices of the Philosophical Society of Glasgow, and the Institution of Engineers and Shipbuilders in Scotland. The Lecture is delivered in the Lecture Hall of the Watt Institute, Greenock, and the Dinner takes place, as a rule, in the Grand Hotel, Charing Cross, Glasgow. The constitution of the Greenock Philosophical Society provides, that an extraordinary meeting should be held every year, in January, in honour of the anniversary of the birth of James Watt. The Society do this—to quote the words on the statue of Watt, by Chantrey, which stands in the library of the Institute—"not to extend a fame already identified with the miracles of steam, but to testify the pride and reverence with which he is remembered in the place of his nativity." On previous Watt anniversaries the usually brilliant audiences, which assemble to do homage to the memory and genius of Watt, have enjoyed listening to such celebrated men as Professor Joule, Sir William Thomson, Professor Fleming Jenkin, and Mr. Scott Russell. Men too, of less universal fame than these, but who have largely shared in developing the great improvements initiated by the discoveries and inventions of Watt, have been elected to the honoured duty of expatiating on the character and results of Watt's great work. Mr. Robert Duncan, of Port Glasgow; the late Mr. William Davey, of Dumbarton; Dr. A. C. Kirk, and others of like standing in the engineering world, have in turn delivered the Watt Lecture.

On this last occasion—the 18th of January—the lecturer was Professor Henry Dyer, Vice-President of

the Institute of Engineers and Shipbuilders in Scotland who chose as his subject, "The Steam Engine in the Days of Watt." The first portion of Mr. Dyer's lecture was mainly taken up with a dissertation on the latent properties of heat. In the course of the lecture he referred to the two great inventions of Watt, the use of the expansion of steam, and of the steam-jacket, which he said had received their greatest development in marine engines, that branch of engineering in which economy of fuel had been of the greatest importance. Having briefly indicated a few of the historical facts connected with that development up to the introduction of the triple and quadruple expansion principle, he said it was satisfactory to find that, as had been the case with the ordinary compound engine, Clyde engineers had kept the lead in that department; and to Dr. A. C. Kirk the first place was given unanimously for having made the triple-expansion engine a commercial success. In all essential details the steam boiler was almost exactly the same as when compound engines became general, except in the matter of strength.

Steel was now almost exclusively used in the construction of their shells, and this in special forms had enabled them to be safely worked up to a pressure of 200 lb. per square in. For some time past considerable attention had been paid to the subject of forced draught connected with boilers, and which was intended to supersede or supplement the natural draught produced by the funnel. There could be no doubt but that it was destined to have very wide applications in the future. The use of steel had been the means of reducing the weight of marine engines and boilers to a very considerable extent—a point, however, which deserves more attention than it had hitherto received, as every ton of deadweight capacity was worth to the owner, on an average, about £10 per annum for freight. The lecturer briefly recapitulated the chief stages in the increase in pressures of the steam in marine engines, and the consequent improvements in efficiency. What shipowners cared about, he said, was the consumption of coal per ton carried and the speed at which it was carried, and to show the advance in this respect, he cited the fact that the first steamers of the Cunard Company were under contract to go at a speed of 8½ knots, while they indicated 740 H.P., and consumed 4·7 lb. of coal per I.H.P. In 1879 the *Arizona* had an I.H.P. of 6,000; she burnt 5 cwt. of coal for every ton of cargo carried, and her speed was over 16 knots.

Since 1879 many huge steamers have been placed on the Transatlantic service, and the passage is now accomplished at a little over six days, at a still further reduction of coal per ton of cargo carried. Mr. Dyer then alluded to the progress made in stationary and locomotive engines since the days of Watt, and concluded by referring to the observation by Professor Huxley, that the end of this century would see us engaged in a commercial war which would exceed in severity any of the military wars in which we had been engaged at its beginning, urging as a remedy the formation of scientific organisations.

The Dinner, which took place on the evening of the anniversary—the 19th January—was largely attended, many of those present being renowned as engineers, shipbuilders and scientific experts. Dr. J. B. Russell, President of the Philosophical Society of Glasgow, occupied the chair, and the croupiers were Professor Jamieson, Professor Henry Dyer, of the Glasgow Technical College, and Mr. James Mollison, of Lloyd's Register of Shipping. Besides the customary loyal and patriotic toasts and the toast of the evening, several others were proposed, *e.g.*, "The Shipbuilding and Engineering interests of the Clyde and West of Scotland," "The Town and Trade of Greenock," "The Philosophical Society of Glasgow," "The Institution of Engineers and Shipbuilders in Scotland," all of which were ably proposed and responded to. In giving the toast of the evening, Dr. Russell briefly sketched the career of Watt, and pointed to the commercial and sanitary progress made since his time. Though long dormant, the powers of light were now waging successful war against the powers of darkness. One of the results was that we had at this moment a larger number of healthier and happier people living under the mingled conditions of city life than ever had been at any period in our history, and they had been brought together by, and could not be sustained without, the inheritance of the genius of Watt.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty, from January 25th to February 22nd, 1889.

Aborn, George, chief engineer to the *Excellent*, additional, to date February 2nd.
Allen, Henry J., assistant engineer to the *Northampton*, to date February 9th.
Allen, Jos. Wray, chief engineer to the *Daphne*, re-appointed on promotion, to date February 10th.
Ash, Harold E. H., assistant engineer to the *Severn*, to date February 19th.
Bills, Wm. H. F., staff engineer to the *Orlando*, to date January 29th.
Bishop, Thos. H., acting engineer to the *Mersey*, to date February 9th.
Black, Wm. J., engineer to the *Bellerophon*, to date March 1st.
Blasa, Albert V., engineer to the *Thrush*, to date February 19th.
Carruthers, David J., assistant engineer (probationary) to the *Bellerophon*, to date March 1st.
Coopper, Herbert, assistant engineer to the *Severn*, to date February 19th.
Edwards, Walter, assistant engineer to the *Orontes*, to date January 25th.
Ewen, George M., staff engineer to the *Conqueror*, to date February 16th.
Hammond, Henry T., engineer to the *Barrosa*, to date February 19th.
Hook, James, fleet engineer to the *Hector*, to date January 25th.
Hornsby, Richard S., engineer to the *Redbreast*, to date January 24th.
Hughes, Thos., staff engineer to the *Australia*, to date January 29th.
Hunter, Robert A., assistant engineer to the *Iris*, to date February 9th.
Jenkins, John E., engineer to the *Asia*, additional, to date February 19th.
Jennings, Robert J., assistant engineer to the *Rodney*, to date February 9th.
Laughrin, Henry, staff engineer to the *Malabar*, to date February 16th.
Lee, Richard S., fleet engineer to the *Asia*, additional, to date February 16th.
Littlewood, Alfred W., probationary assistant engineer to the *Malabar*, to date February 19th.

Marcom, Wm. C., assistant engineer to the *Bellerophon*, to date March 1st.
Martell, Percy D., assistant engineer to the *Warspite*, to date February 9th.
Murray, George W., assistant engineer to the *Collingwood*, to date February 9th.
Nibbs, Charles W., fleet engineer to the *Bacchante*, to date February 19th.
Norgate, Robert S. G., engineer to the *Redpole*, to date January 24th.
Norris, Colin McK., engineer to the *Bullfrog*, temporarily, to date February 19th.
Price, John F., engineer to the *Bellisle*, to date February 19th.
Rodet, Ernest W., assistant engineer to the *Inflexible*, to date February 9th.
Stevens, Wm. C., assistant engineer to the *Bellerophon*, to date March 1st.
Stewart, Charles E., staff engineer to the *Bellerophon*, to date March 1st.
Thomas, Joseph P., chief engineer to the *Excellent*, additional, to date February 2nd.
Ward, John F. H., assistant engineer to the *Severn*, to date February 19th.
Willey, Edward H., fleet engineer to the *Severn*, to date February 19th.

HOAR & BROWN'S HARDWOOD MARKET REPORT, February, 1889.

TEAK.—The deliveries for the four weeks ending the 15th instant have been 861 loads, and although these figures show a considerable falling off as compared with those of last year, which were unusually big, the market is, nevertheless, very firm, and prices still show an upward tendency.

The stock, on the other hand, is very small, and stood on the 1st February at 4,560 loads of logs, against 8,590 loads in 1888, and 13,072 loads in 1887.

The stock afloat is also very small, and what there is has, we believe, all been sold. There are one or two cargoes offering for forward shipment, but shippers' views are so absurdly high, owing, no doubt, to one or two recent sales at high prices, that all chance of speculation is out of the question, and until they—the shippers—become more reasonable, we fear there will be no business done.

The general opinion appears to be that we shall see prices well maintained, with a prospect even of higher figures later on in the year. Prices for landed stock are for the present being kept at a reasonable standard by the arrival of cargoes which were shipped for the dealers at the original low figure of some 40s. less than present F.O.B. values.

Bangkok timber is coming generally into consumption, the difference in price being an inducement to buyers throughout the country. Several first-class reports have been received upon the new mill-sawn carefully-selected cargoes, and should the shipments continue to hold their present character, there will soon be very little margin between the price of this wood and moulmein.

GREENHEART.—The stock is being reduced slowly. There are no fresh arrivals to report and prices remain firm.

MAHOGANY.—The arrival of a steamer cargo bringing a prime shipment from Honduras, and the report of three others to follow, with some cargoes expected from Tobasco, is making business somewhat flat, buyers holding off until they can better judge the feeling of the market before giving the advanced prices now ruling.

The wood for some of the contracts taken last year, and not yet fulfilled, must necessarily be taken from these new stocks, and several other contracts have also been lately settled and distributed, which will make competition keen among the wholesale buyers, and leave a firm market for some time to come. Cuba still remains cheap, and size for size can beat other descriptions in price. There is a good supply at present on the market.

CEDAR.—The usual holders are almost cleared out of stock, but the demand is very limited, consisting mostly of inquiries for small parcels of boat-building wood.

AMERICAN WALNUT.—Logs have been going better, and several transactions are recorded, but no advance in price is yet perceptible, although a tendency shows itself in that direction for well-made good conditioned imports. The imported board and plank trade has improved considerably, inferior consignments particularly realizing a decided advance upon old figures.

SEQUOIA may be said to be doing well, the market commanding somewhat increased prices, and sales are frequent, although of limited nature.

SATIN WALNUT is doing much better, and there are several inquiries about. Imported boards, planed both sides, have met with a ready sale, and the few logs which remained in dealers' hands are now cleared up.

General business during the month has been slow and of a limited character, principally owing to uncertainty on the part of consumers as to the position of the market in the near future.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

COMPARATIVELY few shipbuilding orders have been booked on the Clyde during February, though it is understood that some very important inquiries for large vessels, including some special liners, are being made. The Fairfield Shipbuilding Company, Govan, have contracted to build two large steel vessels for the North German Lloyd's Company, of similar design, but larger than the *Dresden*, recently completed by this firm. The new Government cruiser *Magicienne*, built at Fairfield, left for Portsmouth on the 11th inst., after a trial of her engines in the firth. At the annual supper of the Fairfield engineering staff, held in the Grand Hotel on the evening of the 8th inst., Mr. Andrew Laing, head of the engineering department, alluded to the enlargements and improvements at present being carried out at the works. These include the building of an additional boiler shop, fitted with a 100 tons travelling crane, and all the most perfect labour-saving appliances; the doing away with any antiquated tools still remaining in the other departments, and the adoption in their stead of the best and most modern machines obtainable; and numerous other alterations in the direction of increased efficiency and reduced cost of production.

Messrs. William Denny & Bros., Dumbarton, have contracted to build a large steel twin-screw tug for the Clive Steam Tug Co., of London and Calcutta. This vessel, which is intended for towing the very large sailing ships which have engaged in the Eastern trade during the last few years, will be the largest and most powerful tug on the Hooghly River. She has been designed by Mr. Walker, the company's superintending engineer at Calcutta.

Messrs. Scott & Co., Greenock, have secured a contract to build a steel paddle steamer, 172 ft. long, 22 ft. beam, and 8 ft. deep, for the London, Brighton and South Coast Railway Co. She is intended for the Isle of Wight service, and is to have a high rate of speed. Messrs. Scott have purchased for about £15,000 the shipbuilding yard formerly occupied by Messrs. Steele & Co., which has remained closed for about three years. Several years ago they acquired the graving dock in connection with this yard, and they have now three separate shipbuilding establishments in Greenock. The yard just purchased is to be fitted with new machinery and all appliances required for the construction of the largest vessels both for war and mercantile purposes. We also understand that extensive additions to their engine works are to be proceeded with, and these signs are regarded as pointing to a large tonnage on hand, and the probability of abundance of work for some time to come. The two gunboats now building by this firm are in a forward state, but as they are well before the time required for completion by the contract, operations on them are not being pushed. Messrs. Scott & Co. are said to be negotiating contracts for several additional Government gunboats. Messrs. Russell & Co., Greenock, have effected the sale of two large sailing vessels built for the market, and Messrs. Paul Jones & Sons, Gourock, have booked an order for a 45 ft. steam yacht, to be entirely constructed of teakwood.

Messrs. Hutson & Corbett, Glasgow, have contracted to build triple-expansion engines of about 1,200 I.H.P. for a steamer, to be constructed by Messrs. Priestman & Co., of Sunderland. The Union Steamship Co.'s mail steamer *Pretoria* has recently been thoroughly overhauled, and had her engines altered to the tri-compound system by Messrs. J. & J. Thomson, Fin-

the Govan Engine Works, Glasgow. At her official trial trip in smooth water on the 26th ult., she indicated 3,657 H.P., and attained a speed of 14·8 knots per hour. This is an increase of ¼ knot and 800 H.P. over the result of her trial trip with the ordinary compound engines. The *Pretoria* was also fitted with refrigerators and cold air chambers and a complete installation of electric light. Messrs. Simons & Co., of Renfrew, invited a number of gentlemen, on the 8th inst., to witness a trial of the new patent hopper dredger, *Otter*, built for the Natal Harbour Board. This vessel, which is the first of a new type of dredger, is 170 ft. long, 32 ft. beam, and 14 ft. deep. She differs from other dredgers in having the stern divided for the projection of the bucket-ladder, instead of the base forward, thus securing a solid instead of a divided bow.

Boilermakers are exceptionally busy, and have every prospect of being so for a long time to come, as numerous inquiries, certain to result in large orders, are in the market. Among other contracts recently placed, Messrs. William Wilson & Co., Lilybank Boiler Works, Glasgow, have received an order for two large boilers from Portsmouth. A peculiar feature of this contract is that Lowmoor iron plates, costing about £25 per ton, are to be used instead of steel.

At Dundee the engineers' strike for a second advance of 1s. per week, which commenced at the end of January, still continues; and, in the meantime, there is not much prospect of a settlement, as the employers remain firm in their refusal to add a second shilling to the advance conceded some time ago. The men, on their part, say that the demand is quite justifiable, as wages are lower in Dundee than in any other part of the country.

Messrs. Ramage & Ferguson, of Leith, have been refitting the 400-ton composite steam yacht *Saidé*, lately bought by Mr. Miller, of Australia, from the Duke of Norfolk. Many improvements have been effected in her equipment, and she has been fitted with a new patent Bevis shaft and feathering bronze propeller.

The Grangemouth Dockyard Co. have, we understand, secured a contract to build a 1,200-ton steel sailing barque for Liverpool owners, and also a 550-ton steel screw steamer for Stavanger, Norway. One of these will be built at their recently acquired Alloa yard.

Mr. D. Robertson, late of the London and Glasgow Engineering and Shipbuilding Co., Glasgow, has been appointed chief surveyor of the Bureau Veritas for the Clyde district. Mr. Robertson was formerly chief surveyor for Scotland to the Liverpool Underwriters' Registry for iron vessels, now merged in Lloyd's Registry. The Clyde Steamship Owners' Association resolved on the 18th inst. to present a petition against the bills promoted by the Caledonian and Glasgow and South-Western Railway Companies, empowering them to provide and use steam and other vessels on the Clyde. The question of accommodation for the cross-river traffic at Glasgow is at present exercising the minds of the members of the Town Council and Clyde Trust. The provision for cross-river vehicular traffic has long been quite inadequate to the wants of the city, but the difficulty of suitably providing for it without undue interference with the river traffic, has prevented anything being done. There is now, however, a feeling among all classes that the matter can not be much longer delayed, especially as the foundations of the Glasgow Bridge, which accommodates an enormous vehicular traffic from the western portions of the city, are being weakened by alterations taking place in the level of the river bed. Of the various schemes proposed to meet the wants of the case that for the construction of a three-tunnel subway from Finnieston to Plantation is in the most forward state, the Bill for its construction having passed the Standing Orders Committee in January. A swing bridge at some point below Glasgow Bridge is also spoken of, and a bridge of this description, designed by Mr. Deas, the Clyde Trust Engineer, is looked upon with favour. There is at the same time an idea prevalent that nothing short of a high-level bridge, permitting uninterrupted traffic, both across and up and down the river, will afford a satisfactory solution of the difficulty. Mr. William Arrol has designed a bridge, with a clear headroom above the quays of 100 ft., with ascending and descending inclines, and also hydraulic hoists, which he estimates might be built across the harbour at Finnieston for about £150,000.

Greenock, which for several years past has been under a financial cloud, seems to be fast recovering her former prosperity. We have already alluded to the extensions of Messrs. Scott & Co.'s establishment. Several other industrial enterprises of considerable magnitude are at present being discussed, among them being a project for the erection of large tanks on the outer embankment of the James Watt Dock, for the storage of petroleum oil in bulk, and its subsequent distribution to all parts of the country. The Harbour Trustees have been very successful in their efforts to encourage the discharge of iron ore at the port. A large number of steamers are engaged carrying ore from Spain to the Clyde, and in order to foster this trade, and secure prompt discharge of the vessels, the trustees will probably see the advisability of erecting additional cranes.

The destruction of the training-ship *Cumberland* by fire, through the incendiary act of some of the boys, on the morning of the 18th inst., deprives the Clyde Training Ship Association of a vessel which it will be very difficult to replace. The *Cumberland* was a large wooden frigate, and took part in Rodney's victory off Cape St. Vincent in 1780. She has been moored at the mouth of the Garloch, opposite Greenock, for about twenty years; and during that period over 2,000 boys have been passed through the ship.

TRADE NOTES FROM THE TYNE, WEAR, TEES, &c.

The Tyne.—According to statements purporting to come from reliable sources, orders for new vessels have within the past few weeks fallen off to a very marked extent, and though shipbuilders generally are well supplied for the present year, a continuance of briskness in the yards is not likely to be maintained for a much longer period, unless the requirements of shipowners again become as urgent as they were in November last. One circumstance which may have had some effect in checking speculative business by shipowners, is the uncertainty respecting wages adjustments which has lately prevailed. These matters are now, however, settled for the year, and any prejudicial influence they may have exercised upon trade movements may be regarded as non-existent. In addition to the settlement mentioned in last month's Notes, as having been made with the members of the Boilermakers' & Iron Shipbuilders' Society, settlements have since been made with the shipwrights' and the platers' helpers. The former received an advance of 1s. 6d. per week, making the wages rate 36s., with the promise of another 1s. per week in July—the latter also obtained an advance of 1s. 6d. per week, making the wages of outside helpers 27s. 6d., and of furnace helpers 30s. 6d. per week. In this case, also, a second advance is promised in July. The blacksmiths have made a demand for an advance of 10 per cent. on piece wages, and 2s. per week on time wages. This claim has not, at the time of writing, been disposed of, but negotiations are proceeding, and an early settlement is expected. The joiners have put in a claim for a 3s. per week advance, but this matter has not yet received the attention of the employers. It is understood that arrangements are now under consideration, which, if adopted, will have the effect of promoting a better understanding between the employers and the different sections of workmen, and of practically putting an end to the evil of sectional disputes. The yards belonging to Messrs. Armstrong, Mitchell & Co., at Elswick and Low Walker, have assumed an appearance of increased activity lately. At the latter establishment business is especially brisk, no less than nine building berths being occupied with vessels of the largest class. Nearly all the vessels are intended for the oil carrying trade, and four of them have only just been laid down. A splendid steamer named the *Phosphor*, which has been built to the order of a Liverpool firm, is being rapidly made ready for handing over to the owners. It is believed that this great firm are likely to be the successful competitors for an important contract now in the market, and for which the leading shipbuilding firms on the Tyne, the Clyde, the Thames, and the Mersey, were invited to tender. The contract in question is a fast cruiser of the largest class for the Brazilian Government, and as Messrs. Armstrong, Mitchell & Co. have already been the recipients of orders from the same quarter, their chances of success on the present occasion are understood to be exceptionally good. The pressure of work at Messrs. Hawthorn, Leslie & Co.'s yard continues very heavy, some important repair contracts having been obtained, to supplement the extraordinarily large amount of new work, which was already in progress. Among other orders now in hand may be mentioned

three large steamers which are specially designed for employment in the cotton trade. These vessels are being constructed with even more than the exceptional attention to detail, for which this firm is noted, and which constitutes one of the reasons why the work turned out is so invariably excellent. Messrs. Palmer have launched during the month two vessels, named the *Earnforth* and the *Redruth*. The latter is ordered by a firm at Cardiff, from which port a great many orders have come to the North lately. The Tyne Shipbuilding Co. are fitting out a very handsome steamer named the *Dora Forster*, which has been built to the order of a London firm, and is the first vessel launched from the company's yard this year. Messrs. R. Stephenson & Co., Hebburn, have four large vessels on the stocks, one of which is nearly ready for launching. At the launch of the s.s. *Pocohantes* from this firm's yard, which took place early in the month, an accident occurred through the use, it is stated, of a wire rope to check or "bring up" the vessel, instead of the cable chain ordinarily employed for this purpose. As soon as the vessel had become water-borne, the rope suddenly snapped, and the vessel struck the opposite bank of the river with great force, doing considerable damage to her stern frame, and still greater injury to a couple of small craft which had been moored at the point where she struck. The fine steamer *Hindoo*, which was built and engined by Messrs. R. Stephenson & Co., has undergone a most successful trial, the action of the engines coming quite up to the expectations entertained of them. The boilers are fitted with Henderson's self-cleaning furnaces, the working of which, during the trial, attracted much attention. The trial was in many respects most interesting, but there is no doubt that the last-named auxiliaries to rapid and sustained steam generation contributed largely to the generally successful results. Messrs. W. Richardson & Co. launched, on the 18th inst., a very elaborately finished vessel named the *Citta de Genova*. The vessel is intended for the passenger trade, and is, it is stated, a sister ship to the *Adelaide Lavarello* launched by the same builders in December. The firm are fitting out the large passenger steamer *Sikh*, beside their yard, and they have four or five other vessels of a superior type upon the stocks. Messrs. C. S. Swan & Hunter have now two vessels laid down in their "east" yard, and four in their "west" yard, making six in all. A considerable proportion of the operatives recently attempted to control the action of the firm in their choice of a new manager for the yard. Before the notices expired, however, wiser counsels prevailed, and the men withdrew from the position of interference with the undoubted prerogative of the employers. The new manager is, of course, retained. Through the yard-extension recently carried out by Messrs. Schlesinger, Davis & Co., they have been able to increase their building capacity by bringing the number of available berths up to seven. These are not all occupied at present, but it is understood that they very shortly will be. Messrs. W. Dobson & Co. have just completed the fitting out of the *Port Caroline*, a splendid steamer built by them for Messrs. W. Milburn & Co., London. It is stated that the firm have another steamer of the same type to build. Messrs. Wood & Skinner, Messrs. Edwards & Co., Messrs. T. & W. Smith, and Messrs. Readhead, have all an adequate supply of work in hand. In the repairing line business is extremely active, the whole of the shipways and dry docks being pretty constantly occupied.

Engineering.—The wages question in the engineering trade is now settled, the men having agreed to accept an immediate advance of 1s. per week, to be followed by an advance of another shilling later on. A similar advance has been conceded to the men engaged in most of the subsidiary branches connected with the trade. The Wallsend Slipway and Engineering Co. are now engaged in engining the large steamer *Gutenfels*, built by the Sunderland Shipbuilding Co. for German owners. The firm have an immense quantity of other work in hand, and are utilising their unique resources to the fullest extent, with a view to meet engagements. The other large marine engineering works continue to show the utmost briskness, and the operatives, when they are not on night shift, are generally required to work to a late hour nightly. Owing to an inadequate supply of labour, iron founders are finding it exceedingly difficult to meet their engagements respecting delivery of work contracted for. Some of the firms have, by the extension of premises and the acquirement of additional plant, managed, so far, to successfully cope with the difficulties of the situation, but in the majority of cases the opportunities for enlarging the productive powers were few and limited, and in these instances, the inadequacy of the labour supply is still found a serious hindrance to business. Messrs. John Abbot & Co. turned out some very heavy castings lately for Messrs. Doxford & Sons, Sunderland. One of these —a bed plate—weighed nearly 20 tons. In the establishments devoted to the manufacture of windlasses, steam winches, steering gears, &c., business is as brisk as ever, and manufacturers of wire rope for steamers' rigging, are plentifully supplied with orders. Extraordinary activity is still the feature at Messrs. Spencer's steel works, Newburn, and the forge works of the same firm at Ouseburn are almost equally busy. Great progress is being made with the erection of the new steel works by Messrs. Palmer, Jarrow, the existing works belonging to the firm being in the meantime as busy as possible. The claim put forward by the Northumberland miners for an advance of 10 per cent. in the wages rates, has been met by the coalowners with an offer which, as it closely approximates to the demand of the miners, has been accepted. A strike is therefore avoided.

The Wear.—The Wear shipwrights have accepted an advance of wages equal in amount to that given to the same section of workmen on the Tyne, and so far as they and other classes of skilled operatives are concerned, no troubles in the way of stoppages of work need now be apprehended. A cause of anxiety, however, has arisen from the attitude taken up by the platers' helpers, who have resorted to the extreme course of turning out on strike, because the employers have declined to grant their application for an advance of wages equal to that given to the platers. The employers base their refusal of the helpers' application on the twofold ground that they are already paying higher rates than are paid to the same class in other districts, and that during the depressed period they refrained from reducing the helpers' wages to the same extent as the wages of the other sections of workmen. The facts, as stated from the employers' point of view, are indisputable, and it is therefore likely that they will rather put up with the inconvenience of a temporary stoppage of work, than accede to the helpers' demand. Though new orders are just now not very numerous, work is plentiful at the whole of the shipbuilding yards. The new premises, recently erected by Messrs. J. L. Thompson & Sons in connection with their frame bending department, will shortly be ready for occupation, and the extensions at their Pallion forge are also nearly completed. Messrs. R. Thompson & Sons, have four vessels of a superior type, and of the largest class, on their stocks, and with the aid of new and powerful plant recently put down, they are making rapid progress with their construction. Mr. James Laing has now six vessels on the stocks, this being a larger number than has been simultaneously in progress at his establishment at any former period. Messrs. Doxford and Messrs. Short Brothers have all their available building space occupied. The operatives engaged in the iron and steel departments, under the last-named firm, have received an advance of wages, though they have no connection with the organisation known as the Boilermakers, & Iron Shipbuilders' Society. At Messrs. Priestman & Co.'s yard there are three steamers on the stocks, and an equal number are in course of construction at Messrs. Pickersgills' yard. Briskness is the prevailing feature at all the other establishments, and there are scarcely any idle berths to be seen.

The activity in the engineering trade continues to be very marked, and, excepting in one instance, night work and overtime are being largely resorted to. The exception referred to is the Scotia Engine Works, at the head of which is Mr. William Allan, a gentleman who is not only locally well-known, but who has made for himself many friends in engineering circles generally. This gentleman has resolutely entered upon the experiment of working his establishment without resorting to overtime or night work, and he has every confidence in his ability to make the experiment a success. He has now a good force of hands employed, and as their energies are unaffected by excessive application to their duties, the result of each day's operations certainly seems to be greater than is usually achieved by the same number of workers at other establishments. Despite the great pressure of marine work in his establishment, Mr. John Dickinson has been able to undertake an important contract for repairs and alterations in the machinery of a local flour mill. The Palmers' Hill establishment, however, has been provided with all the best modern appliances for carrying on work, and that circumstance accounts for the exceptional rapidity with which contracts are executed. Messrs. George Clark & Co., of the Southwick Engine Works, has some unusually powerful sets of triple-expansion engines in progress. One of these sets, it is stated, is intended for a first-class passenger steamer which is now being built at

Middlesbro'. At Messrs. Doxford's establishment, and also at the North Eastern Engineering Works, South Dock, a very high state of briskness is still to be noticed.

Steam winch manufacturers continue to be as actively employed as they were throughout the whole of last year. Messrs. John Lynn & Co. have orders on hand for winches, steering gears, &c., to be used on steamers now building at various centres on the North-East Coast. This firm have lately had inquiries from Australia, a circumstance which shows how widely extended is the reputation of their products. Mr. John Wigham, of Hylton, has an abundance of work in his well appointed factory, and his improved winches—some of which have lately been supplied to locally-built steamers—are said to be very highly appreciated by those who have had the opportunity of witnessing their action. Messrs. Welford Brothers are well provided with orders for winches and other deck accessories, and at the Pier Engine Works, South Dock, the state of business is unusually good. Forge proprietors have as much work as they can deal with, and in many cases they are compelled to decline the acceptance of additional contracts. Skilled labour in this branch of industry is particularly scarce just now, and from this cause operations are considerably more restricted than they would otherwise be. The briskness in the shipbuilding and engineering trades has caused a great influx of work to ironfounders, and in all cases extraordinary exertions have to be made to supply the demand for castings. Brass founders are also obliged to put forth their best energies to meet the heavy calls which are daily being made upon them for their productions. The recently started rivet works of Messrs. Irving & Jopling at Pallion are exceedingly busy, and the other rivet manufactories in the district are also doing an excellent business. Messrs. Lumsden & Co.'s Chain Works continue to be well employed, and orders for Byers & Storey's patent anchor are coming in pretty freely. Since the opening of the year the Monkwearmouth Iron Works have shown, if anything, more uniformly sustained activity than was apparent even in the later months of last year, though during the period from midsummer to December, business was much better than it had been for a long time previously. The success obtained by Bell and Rockliff's patent sections (bulwark rails, hatch cleats, &c.) on their first introduction has been improved upon to an extent scarcely anticipated, and there are by this time very few shipbuilders in the country who have not come to appreciate their merits. As a consequence the demand for these specialities is increasing daily, and the briskness at the seat of manufacture increases accordingly. Very active progress is being made with the arrangements for converting the Castletown Iron Works into steel works, and many important machine tool-making firms in different parts of the country are now busy with the heavy machinery ordered by the directorate for the effective initiation of their enterprise. It is to be regretted that the undertaking was not entered upon a little sooner, so as to give the works a chance of participating in the brisk business now doing in the steel trade. Several of the gentlemen, however, who have given their support to the enterprise are themselves large consumers of steel plates, angles, &c., and this circumstance will doubtless ensure for the establishment a steady run of work when it does get under way. A new company for supplying the electric light to business establishments and private residences in Sunderland has been registered. The names of several influential local gentlemen appear among the list of directors.

The Hartlepools.—The wages dispute in the shipbuilding trade, to which reference was made last month, has been settled, but not before a good deal of valuable time was lost both to the shipbuilders and the operatives. The men receive an advance of 7½ per cent., which is to cover the interval between now and the beginning of November. This differs slightly from the settlement effected on the Tyne and Wear, where the men receive an immediate advance of 5 per cent., to be increased to 10 per cent. at the beginning of July. The difference indeed is so trifling that it is surprising how some thousands of workmen should think it worth their while to lose three weeks' wages in fighting for it. Messrs. W. Gray & Co. have just launched a splendid steamer, ordered from them by Messrs. T. Wilson & Sons, Hull. The vessel, which was named the *Clio*, will be a notable addition to Messrs. Wilson's fleet, being elaborately fitted up for the conveyance of passengers and cargo. The engines, of 1,200 H.P., will be supplied by the Central Marine Engineering Co. It may be stated that this is one of half-a-dozen large steamers ordered some time ago by Messrs. Wilson, but the orders for which were distributed among different builders in the North. Tyzack's patent anchors have, it is understood, been specified for the whole of these steamers. At Messrs. Withey's establishment the greatest activity is still to be noticed. The amount of repair work coming to the port is very considerable. Among the numerous contracts in course of execution by Messrs. T. Richardson & Sons, is the engining of a large vessel lately launched by Messrs. Short Brothers, Sunderland, and which is to form an addition to the large fleet under the control of Mr. James Westoll. Local cement works are exceedingly busy just now, the demand for this commodity having greatly increased.

Stockton.—The settlement made with the shipyard operatives at the Hartlepools also applied to the Stockton yards, but on its completion work was not immediately resumed, as was the case at the former centre, a dispute between the platers and their assistants having unfortunately caused a prolongation of the stoppage. This matter, however, was ultimately settled, and at the time of writing the whole of the yards are again in full swing. The Stockton shipbuilders have, even in the dullest times, been proverbially successful in obtaining work, and there is consequently nothing surprising in the circumstance that at this moment, when work in the shipbuilding trade is generally plentiful, an exceptionally large share of it should have come to this centre. Each of the three yards is showing the utmost briskness, and the present activity in the designing departments is a guarantee that this state of matters is bound to be continued for many months. The same exceptional activity characterises the engineering works, and boiler and bridge works may fitly come under a similar description. The Stockton Forge continues in full activity, and other works of a kindred nature are, without exception, well employed. Manufacturers of gas-making plant are fairly well off for orders, and bottle manufacturers continue to do a satisfactory business. The minor industries generally are tolerably prosperous, and employment for both labourers and mechanics being abundant, the aspect of affairs in the borough is, from a business point of view, encouraging.

Middlesbro'.—The Middlesbro' shipbuilders have enjoyed the advantage of having their yards kept uninterruptedly in operation, the wages question having been settled in their case almost immediately on the expiration of the men's notice for an advance. Among other important contracts now in course of execution by Messrs. Raylton, Dixon & Co. is the building of a large steamer for one of our leading passenger lines. This firm have turned out some exceptionally fine steamers in their time, but the vessel now referred to will probably eclipse them all in point of elaborateness of finish. It may be recollected that in the course of last year this firm leased for a period a new yard which had been laid out by another local company, but which had not, previously to its occupation by Messrs. Dixon & Co., been put in operation. This yard, as well as the other establishment with which Messrs. Dixon & Co. have been identified for a great number of years, is now in full swing, and the combined output of the two concerns this year will doubtless largely exceed all former yearly returns of tonnage launched on the Tees. The larger engineering works at Middlesbro', though not particularly busy, are doing, on the whole, a steady trade, and the boiler and bridge works are fairly well employed. The iron trade continues to show an improving tendency, and prices, both of the finished and the crude article, are decidedly firmer. The activity in the steel works could not well be exceeded, and in the foundries there is quite an abundance of work.

Consett.—The Consett Iron and Steel Co. have, by extensions of premises, largely increased their productive capacity, but in spite of this added power of production their resources are now taxed to the uttermost to meet the demand for plates, angles, &c., coming from the different shipbuilding centres of the North.

THE MERSEY.

APART from the sailors' strike (which, unfortunately, assumed larger dimensions than we anticipated when writing last month) and the interest taken in the various local Bills before Parliament, of which, by the way, there is an unusually large number, there was but little to chronicle in connection with the Mersey in the early part of February. Another case of a Liverpool-owned vessel being built away from the Mersey has

to be recorded in the construction of the *Eden Vale*, designed for passenger and other traffic between Wexford and Liverpool. This vessel was launched on January 29th by Messrs. McKnight & Co., of Ayr, to the order of Mr. John Bacon, of Liverpool. When will the local builders look sharper after their own interests?

Unfortunately the Woodside Ferry receipts still exhibit a tendency to grow beautifully less by degrees, the returns for January giving the total receipts for day passengers as £679 15s. 10d., against £1,316 17s. 3d. in the corresponding month last year. The year just passed shows a reduction in the yearly contracts of £346, in the monthly contracts of £18, and in the weekly contracts of £37. It is to be hoped that the revival of trade may prove that better things are in store for the ferries. The past twelve months have been a very satisfactory period so far as the timber trade of this district is concerned, the returns, spite of high freights and exorbitant insurance charges, being higher than any during the last four or five years. Taken all round, prices have ruled decidedly firm, and the demand has been in every way a good one.

The gale which favoured us with a visit on the 8th and 9th of February caused considerable damage and delay to the shipping, the ferry traffic—during the busiest part of the day—having to be suspended, many vessels were driven back to the port, while others dragged their anchors in the river. A Liverpool tug, while bringing the disabled steamer *Mascotte* from St. Vincent—another remarkable feat in towing, and a feather in the cap of Liverpool tug owners—encountered the full force of the gale, but succeeded in bringing the steamer safely into port.

The directors of the Isle of Man Steam Co. recently asked for £130,000 in debenture bonds of £100 and £500, redeemable in five or seven years, and carrying 5 per cent. interest. Applications were made to the extent of £270,000 by 375 would-be subscribers, a very gratifying result, and one indicative of every confidence in the old company, who may safely look forward to a very prosperous season.

In the live cattle and fresh meat imports there is nothing to complain of, the numbers in each case coming well up to expectation.

The Liverpool Engineering Society had a very successful meeting on the 6th, and listened to an interesting discussion on Mr. H. H. West's paper (read at the previous meeting) on "Steel in the hands of the Naval Architect."

Lord Derby proposed, at an extraordinary general meeting of the proprietors of the St. Helens and Wigan Junction Railway Co., that the line should be called the Mid-Lancashire line, a proposal which was adopted by the meeting.

The close of the month happily saw the termination of the unfortunate strike amongst the sailors and firemen, the men having decided for the present to accept the masters' terms. At a well-attended meeting, held in the Trades' Hall, it was resolved to resume duties on all the Western ocean steamers, both mail and cargo, at £4 for sailors and £4 10s. for firemen, provided the masters will take into consideration their present demands on and after May 1st. We are all wise after an event, and the men now find they have made a mistake by agitating at the wrong time, and they consider that if they had waited until the height of the passenger and emigration season in April and May they would have been more successful in their demands. The men were becoming desperate, and it is fortunate that the dispute is even temporarily settled, for they had gone the length of sending a letter to the Cunard Co., threatening to burn down their sheds if their demands were not granted soon. The crews of newly-arrived steamers had to leave their ships under police protection, and a general feeling of uneasiness prevailed in the town.

Though there is at present nothing much to note in connection with the constructive departments of this district, we hope shortly to have to report more favourably in this direction, there being rumours of orders about.

WELSH NOTES.

THE chief subject of general interest in Cardiff at present is the Bute-Taff joint-working scheme. When an amalgamation was proposed a year ago, a majority of the Taff Vale shareholders were opposed to it. It was contended that however desirable any such union might be from some points of view, the time was not yet ripe. In a few years' time things might probably be different. It has taken months, not years, to change the views of the greater number of the Taff Vale proprietors, and now it is agreed that the Bill to come before Parliament in the current session shall be supported. The scheme is to pool the nett receipts of the two undertakings and divide the sum as may afterwards be decided upon. This appears a very loose way of doing things, and at the last Taff Vale meeting some shareholders very naturally wanted to know how the division of profits would be arrived at, but no satisfactory explanation was forthcoming. The inquiring shareholders were reminded that the majority of the Civil Committee would be Taff Vale nominees, and that therefore no need for distrust existed. This may be so at the beginning of the arrangement, but as there is to be no approbation period, it is distinctly unfair that such a loose system should have been hit upon. What cause is there to believe that at some future date the Taff Vale nominees may not find it better from their point of view to favour the Bute Docks Co.? We do not suggest that this will happen with anyone now on the Taff Vale Board, but changes do occur in the course of years. It is very strange, by the way, that the Bute Dock Co. should have declared a 6 per cent. dividend for the first time this year. That it was possible to do so, however, shows that trade at Cardiff for 1888 showed a very decided improvement, as the dividend of the previous year was less than 4 per cent. Under such circumstances as these there need apparently be little fear of Barry doing very much harm to Cardiff Docks, for it will be remembered that the Bute Trustees were said by one of their witnesses before the Barry Parliamentary Committee to have never received more than 3½ per cent. upon the money they laid out over their Cardiff Dock property.

Swansea, like Cardiff, had a particularly good year in 1888, for the volume of its trade excelled that of the previous best year, 1883, considerably. But the direct export of tinplate from the States fell off again to an extent of some 2,821 tons; the falling off for the previous year, 1887, was 5,464 tons. There must be some further reason for this than an extra demand for deadweight cargo on the Liverpool liners. With the year the increase in tinplate exports on the whole is less than 1,000 tons, or rather worse than any other branch of the port's shipments.

At Newport, on the other hand, shipments of 1888 showed a decrease compared with the previous year, and they continue to fall off. The local Chamber of Commerce have the matter under consideration, and promise to give the reasons for such an unfortunate state of affairs at an early date. We trust that they will be able to do so, and that a speedy remedy may be found.

It is expected that Barry Dock will be opened about next May. The line from Cardiff to Barry is now in order, and trains are running at regular intervals.

The other new Welsh Railway, Rhondda and Swansea Bay, held their half-yearly meeting on the 24th ult., and, as usual, a small dividend was declared, with the ordinary share as well as the usual preference dividends. It is to be noted that the dividend thus paid is out of money actually earned, not out of capital. By the way, the Swansea Harbour authorities are, in conjunction with the G.W.R., extending the siding and tipping accommodation at the Prince of Wales' Dock; in view of the approaching opening of this new line, the traffic from Port Talbot to the Swansea Docks will be taken by the G.W.R. Co.

Serious disturbances are promised in connection with the South Wales coal trade. The men claim an advance of 10 per cent., the masters have offered five per cent. advance, provided the men will forego their own monthly holiday; the offer has been placed before the men at the various collieries, connected with the sliding scale arrangement, for their consideration. So the matter rests at the time of writing these Notes. There was a meeting of miners at Aberdare, on the 18th ult., at which the views of the masters were placed before them, and the decision we have named above come to. Very strong language was indulged in at the meeting, and the men appear to be in no mood to give way. What they make a complaint about is that the sliding scale, by which their wages are regulated by the prices received by the masters for large coal, was proved a failure. Audits are only held once each six months, so that six months elapse between an improvement in coal price and any increase in the men's wages. They consequently demand audits being more frequently made. In addition to which they complain that the masters make long contracts, which prevent any advantage

being taken of improved prices in many cases, and that in some instances the truck system is still pursued. For as regards the latter complaint, everybody will side with the men; but as regards the question of contract, it is difficult to see what just ground of complaint the men can have—they fare no worse than do the employers. The workmen at the Ocean Collieries form a distinct society to their fellows at the other Welsh collieries, and have already dissolved their sliding scale Committee. It is possible that by the time these lines are in type a conclusion will have been come to one way or another; it is to be hoped that, whatever this may be, a strike will be avoided.

There is also a dispute amongst the tinplate workmen at two of the largest works in South Wales—the Upper Forest and the Worcester, at Marriston, near Swansea. The cause of disturbance there was nothing to do with wages, but two men were recently discharged by the proprietor of the works for incompetence. This the rest of the workmen objected to, and said if they were not taken back they would all go out on strike. The result was exactly what one might expect: the employer refused to be dictated to, the men gave 28 days' notice, so that there is now every likelihood of some 1,000 men being thrown idle next month.

Not a little attention has been roused in South Wales by the formation of North's Navigation Collieries, Limited, with a capital of over £400,000. Some eight months ago the property, the well-known Llynir and Fundu undertaking, was purchased by a syndicate, of which Colonel North formed one. During the time he possessed the property coal prices went up from 8s. to 14s., with the result of six months' working showing a profit of some £18,000. This was thought to be a good enough bait for the gullable public, so a syndicate easily sold for £350,000 part of that which had cost them a very short time before £150,000. The transaction shows a very handsome profit. North gets £92,000 as his share—not a quarter-of a million, as some people say. All, however, is not going so merry as the proverbial marriage bell, for there are rumours of law suits, and in connection with them the most utter nonsense has been preached by one or two London and provincial papers, which apparently know less of South Wales coal than of anything else. If any law-suit does arise, we should imagine it ought to be in connection with the sale of the property at the price at which the North Syndicate bought it. South Wales people who know Llynir property are asking how long it will be before the new owners follow their predecessors.

Since our last Notes were written an election of a Swansea Harbour Trustee has been held, and several outcries have been raised as to the old-world system of voting pursued. It is open instead of being by ballot; and although several attempts have been made to secure the more sensible system, the old fashion continues to reign supreme.

A new tinplate works, named the Villiers, has recently been started at Hinton Ferry, and a new tinplate company is stated to have been formed at Llanelly. Other new works are in contemplation, so that there is every reason to believe that the South Wales tinplate workers will before long experience further bad times. The great curse of the tinplate trade is that the people engaged in it pay no attention whatever to the inexorable laws of supply and demand.

We observe that promoters of that wild canal scheme, the Great Western Ship Canal, are again writing lengthy epistles to various papers, making the most they can of their ideas. The most amusing fact in connection with this endless letter writing is that the scheme has been condemned on all sides by engineering papers and by financial papers. It has been shown that the figures given by the promoters are wrong; they have been charged with anexing the names of a firm of London solicitors to tack on their papers as the legal advisers of the concern, but notwithstanding all this the letter writers say never a word in reply, but continue their senseless twaddle about the advantages to South Wales of a scheme which nobody in South Wales can derive any benefit from.

A few days ago the first sods of two new Monmouthshire pits were cut at Abertillery. The pits are being sunk for the Abertillery Coal Co., of which Messrs. Macquoil Bros., Cardiff, are general managers. It is stated that the probable output of the pits, when they are in full working order, will be about 2,000 tons per day.

A winding-up order has been made by Mr. Justice Stirling in the matter of the Pyle Works, Limited. The company have extensive works near Bridgend, but appear to have been losing money hand over fist during recent years. The paid-up capital of the company was £60,000, in addition to which £45,000 has been borrowed on debentures at 7 and 8 per cent., and a sum of £81,000 owing to other creditors. It is hoped that with careful liquidation the company will be able to wipe off all its indebtedness and make a new start.

A Cardiff steamer named *Brittany* appears to bring pleasure to nobody connected with her. There is always some dispute on the way. The last one takes the form of a request from the shareholders to the manager to resign his position. It is a noteworthy fact, by the way, that although there are a large number of steamers owned at Cardiff, disputes of this description are rare. That this is so is not due, we are given to understand, to any special skill shown by Cardiff managers, but to the fact that there is no South Wales Ship Shareholders' Protection Association.

Mr. C. Wilkins, of Merthyr, has published a work which he entitles "The History of the South Wales Trade." The subject is a most interesting one, and from what we are led to believe (we have not seen a copy of the publication), Mr. Wilkins has done his work well.

During the past month the Landore Siemens' Steel Works have been sold by auction for £101,000, the purchasers being, we understand, the Messrs. Siemens. It is uncertain what period will elapse before the works are in full swing again, but there is every reason to believe that a fresh start will be hurried on as soon as possible.

BELFAST TRADE NOTES.

THERE is no change here since last report, trade still continues extremely brisk, and every appearance of continuing so for the present year. Messrs. Harland and Wolff, Queen's Island, have the new White Star Liner, s.s. *Teutonic*, under the shear-legs at the Abercorn Basin, and are rapidly putting the machinery into her; a fine installation of electric light is being fitted up on her to enable a night shift to work with facility. Their shipbuilding yards have for a long time past been illuminated by electricity, which of course enables shipbuilding to be carried on without variation in the hours worked, summer or winter, as was formerly the case; they are also engaged in making further additions to their engine works.

The s.s. *Runic* (cargo steamer), built by them to the order of the White Star Line, and sister ship to the s.s. *Cufic*, left here for Liverpool on 16th February, the *Runic* is in every way a counterpart of the *Cufic*; the latter has made a very fast passage across the Atlantic. Messrs. H. & W. will launch a fine steamer in a few days.

Messrs. McIlwaine & Maccoll, Limited, have the s.s. *Alps*, which has been in their hands since November last, almost ready for sea. The s.s. *Topic*, launched by them on the 1st January to the order of Mr. R. Grainger, Belfast, has been handed over to her owner finished. They have a large steamer pretty well advanced, and which will be launched shortly.

Messrs. Workman, Clark & Co., Limited, Belfast Shipyard, have the splendid steamer *Star of England*, built by them to the order of Messrs. J. P. Corry & Co., almost fitted out. She will be towed to Glasgow in a few days to receive her engines and boilers. They are very busy and have some vessels in a pretty advanced state.

The Harbour Commissioners have under consideration tenders for the erection of four lighthouses, on screw piles, for the lighting of the channel cut by them in Belfast Lough, and by which all the bends in the channel have been removed. What was some years ago a most tortuous channel will be now perfectly straight; it is dredged to a depth of 17 ft. below low water level.

The new graving dock will be opened in April by H.R.H. Prince Albert Victor. It may interest our readers to know the dimensions, which are:—Length, 856 ft.; breadth, at top between coping lines, 92 ft.; it can be divided into three compartments of 300, 200, and 300 ft. in length respectively, by means of floating gates, or caissons. The entrance to the dock is 80 ft. wide at coping level, and the depth on sill 25 ft. at ordinary high water; the sill is level with the bottom of the dock. The contractors are Messrs. McCrea and McFarland, and the amount of contract about £91,000. It is expected that when H.R.H. is here that he will lay the foundation stone of the New Albert Bridge.

We understand that the Mayoress of Belfast (Mrs. Charles C.

Connor) has accepted the invitation of Messrs. Burns to name their new steamer, which will be launched on 2nd March from the Fairfield Works. This is a splendid paddle steamer, built to the designs of the late Sir Wm. Pearce, Bart., and is intended to be of very high speed; she will be placed on a daylight service between the North of Ireland and Scotland, and will be named the *Cobra*.

LEITH NOTES.

THE briskness still continues here, and night and day shifts are the rule in all the shops. No fresh launches have occurred this month, but Messrs. Ramage & Ferguson and Messrs. S. & H. Morton & Co. have each a hull nearing completion. Messrs. Hawthorns & Co. have laid the keel plates for the first of the four coal lighters to be built by them for the Admiralty. The small steel tug *Condor*, launched by the last named firm last month, left Leith on the 16th inst. for Liverpool, for shipment to Chili.

The magnificent 400-ton auxiliary composite steam yacht *Saide* (late *Star of the Sea*), recently bought by Mr. Miller, of Australia, from the Duke of Norfolk, left Leith on the 7th inst. for Port Darwin, North Australia, *via* Suez Canal and Colombo. This yacht has been in the hands of her builders, Messrs. Ramage & Ferguson, being altered and refitted for her long voyage, and many improvements have been carried out. The masts have been shortened 8 feet, and a square rig has been adopted forward, besides this a new patent Bevis shaft feathering bronze propeller has been fitted. Being of composite build and copper sheathed, she is specially well adapted for cruising in Eastern waters.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Aslacoe.—On Monday afternoon, February 18th, there was launched from the yard of Messrs. Raylton, Dixon & Co. a fine steel screw steamer which has been built to the order of Messrs. Bennetts & Co., Grimsby. Her leading dimensions are:—Length 295 ft.; breadth 42 ft.; depth 21 ft. 4 in., with a dead-weight capacity of 3,700 tons. She is built specially for the timber trade, with raised quarter-deck, T.G. forecastle and long bridge extending beyond foremast. Water ballast in cellular double bottom. Her patent direct acting windlass by Emerson, Walker & Co., Limited. Her engines, which will be fitted by Messrs. Blair & Co., of Stockton, are of 220 N.H.P., with cylinders 23 in., 37 in., and 61 in. by 42 in. stroke. The vessel on leaving the ways was gracefully christened *Aslacoe*.

Steel Coaling Lighters.—On February 18th there was launched from the shipbuilding yard of Messrs. Finch & Co., of Chepstow, two more 150-ton steel coaling lighters, built to the order of the Lords Commissioners of the Admiralty.

Citta di Genova.—On February 18th Messrs. Wigham Richardson & Co. launched from their Neptune Works, at Newcastle-on-Tyne, a steamer for the Fratelli Lavarello fu Gio Batta fleet. She is 300 ft. by 35 ft. by 26½ ft., and is fitted, like her sister vessels built by the same firm, from end to end for emigrants and passengers. As she left her berth she was named the *Citta di Genova* by Miss Margaret White, of Bournemouth. Her machinery has also been constructed by the firm, and is of their well-known Tweedy patent triplex type.

Siggen.—On February 18th there was launched from the yard of Messrs. John Blumer & Co., Sunderland, a screw steamer of the following dimensions:—Length between perpendculars, 290 ft.; beam, extreme, 38 ft.; depth, 19 ft. 11 in. Short poop, long raised quarter-deck, with bridge extending to forecastle, and is built on the web-frame and cellular bottom system, to take the highest class at Lloyd's. The vessel will be fitted out with all the latest improvements. The engines are of the triple-expansion type, by the North-Eastern Marine Engineering Co., Sunderland. On leaving the ways she was named *Siggen* by Mrs. T. R. Blumer. The vessel is owned by Messrs. Harloff & Boé, of Bergen.

Ulysses.—On February 18th Messrs. Cochrane, Schofield & Cooper launched from their shipyard at Grovehill, Beverley, a steam fishing vessel, built for the Grimsby Union Steam Fishing Co., Limited. The vessel, which was named *Ulysses*, is of the following dimensions:—Length between perpendiculars, 105 ft.; breadth, 20 ft. 6 in.; depth, 11 ft. 6 in. The steamer is specially constructed to prosecute the Faroe and Iceland halibut and cod fishing, with a perforated well 19 ft. long. Its engines, which are of 50 H.P., triple-expansion type, will be added by Messrs. C. D. Holmes, of Hull.

Magnus Mail.—On February 19th Messrs. Short Brothers launched from their yard at Pallion, Sunderland, a screw steamer, built to the order of Mr. James Westoll, Sunderland, and of the following dimensions:—Length, 290 ft.; breadth, 39 ft.; depth, moulded, 24 ft. 4 in. The vessel is built of Siemens-Martin steel, and is constructed to the highest class in Lloyd's Registry, with cellular double bottom throughout, the holds being sub-divided by six water-tight bulkheads. On leaving the ways she was named *Magnus Mail*. The engines, which are triple-expansion of 21 in., 36 in., and 57 in. cylinders, and include all the latest improvements, will be supplied by Messrs. T. Richardson & Sons, of Hartlepool. She is fitted with patent steam windlass by Emerson, Walker & Co., Limited.

Clio.—On February 19th Messrs. W. Gray & Co., Limited, launched a fine steel screw steamer of the following dimensions:—Length over all, 310 ft.; breadth, 40 ft. 6in.; depth, 23 ft. ½ in.; built to the order of Messrs. T. Wilson, Sons & Co., Hull. The vessel will take Lloyd's highest class, and has a poop containing saloon and cabins, long raised quarter-deck, deck-house, with engineers' berths; long bridge to fore-hatch, and topgallant-forecastle, with accommodation for crew and petty officers. The hull is built on the web-frame principle, large hatchways are fitted, each having double derricks, shifting boards throughout the holds, four steam winches, steam steering gear amidship, screw gear aft, Emerson, Walker & Co.'s steam windlass, and a large multitubular donkey boiler, water ballast tanks are fitted under each hold, two iron masts, schooner rigged, and a full equipment for general trading will be provided. Fine engines, on the triple-expansion principle, of 1,200 H.P., and large steel boilers are being supplied from the Central Marine Engine Works of Messrs. W. Gray & Co., Limited. During construction, the ship and machinery have been under the superintendence of Mr. J. F. Wilkins and Mr. John Speir respectively, on behalf of the owners. The christening ceremony was gracefully performed by Mrs. McMordie, of Greatham, the vessel being named *Clio*.

Ambaca.—On February 20th Messrs. Earle's Shipbuilding and Engineering Co., Limited, launched from their yard at Hull the first of two steamships they have on order for Empreza Nacional's mail and passenger service between this country, Lisbon, and the west coast of Africa. The ship is built of steel, the dimensions being 340 ft. by 41 ft. by 28 ft. depth of hold to top of floors, and she is classed at Lloyd's as a spar deck vessel on the cellular system, and has a deep hold tank aft. There are three complete decks and a topgallant forecastle, and large houses are fitted aft and amidships for cabin entrances, officers' quarters, &c. Accommodation is provided aft under the spar deck for 72 first-class passengers, the dining saloon and the entrance to their cabin being in the after house, and will be lined entirely with polished marble tastefully decorated, while the cabins will be handsomely furnished in polished hardwoods. Large sliding windows are fitted to give ample light and ventilation. Provision is also made amidships for 32 second-class passengers in substantial style, with dining-saloon and all necessary fittings, and further forward in the 'tween decks is accommodation for 120 third-class passengers, and the crew are berthed in the topgallant forecastle. The ship will be schooner-rigged and have powerful steam winches of Earl's special design, and a Bow McLachlan steam steering gear amidships and screw gear aft. The builders have carried out an elaborate installation for lighting throughout by electricity, in addition to which the usual arrangement for illumination by the ordinary system of lamps will be made. The machinery consists of a set of triple-compound three-crank engines, also of Messrs. Earle's manufacture, with cylinders 32.48 and 80 in. diameter by 48 in. stroke of piston, steam for which will be supplied from two large double-ended steel boilers made for a working pressure of 160 lb. per square inch, and having each six Fox's furnaces fitted with Henderson's patent fire bars.

Gutenfels.—There has just been launched from the yard of the Sunderland Shipbuilding Co., Limited, a finely-modelled spar deck screw steamer, built to the order of the Hansa Co., of Bremen. The registered length of the vessel is 322 ft., beam

40 ft., and depth of hold to top of ordinary floors 28 ft. 6 in. Classed 100 A 1 Lloyds, having bridge amidships under which is the saloon and accommodation for a few first-class passengers, the crew are berthed in topgallant forecastle. The vessel is built with cellular bottom for water ballast all fore and aft, hold beams are dispensed with, web frames being introduced in their place, all weather decks are of wood and all frames are of Z steel. Every provision is made for the rapid handling of cargo, four large hatches are fitted at which are placed five steam winches by Messrs. Welford Bros., Sunderland. Harfield's direct steam windlass is also supplied and steam steering gear by Messrs. Donkin & Nichol, of Newcastle. The main engines have cylinders 23½ in., 39 in. and 64 in. by 42 in. stroke; 160 lb. working pressure. Upon leaving the ways she was gracefully named *Gutenfels* by Mrs. Taree, wife of the superintending captain of the fleet, after which she proceeded direct to the works of the Wallsend Slipway Co., Newcastle, who supply the machinery.

Phosphor.—On January 26th there was launched from the yard of Sir William Armstrong, Mitchell & Co., Low Walker-on-Tyne, a steel tank steamer, built to the order of Messrs. R. Stewart & Co., of Liverpool. The vessel is of the following dimensions:—Length, 280 ft.; breadth, 37 ft.; depth, 25 ft. 9 in.; with a hold capable of carrying 740,000 gallons of petroleum, besides 300 tons of bunker, on a very light draught of water, and is of highest class in Bureau Veritas. She will be fitted with the most improved type of triple-expansion engines of 20, 34 and 55 in., by 36-in. stroke, 200 nominal H.P., indicating 1,100 effective, by the Wallsend Slipway and Engineering Co. She is fitted with 12 separate air-tight compartments, with double bulkheads between the oil and machinery compartments, also with forced draught and all the latest improvements—including two complete sets of Worthington's pumps, capable of discharging the vessel in 12 hours. Accommodation for captain and officers is provided amidships, under bridge spar deck, engineers and firemen aft, and sailors in topgallant forecastle. The steamer is fitted throughout with electric light, including masthead and side lights. On leaving the ways the new vessel was named the *Phosphor*, by Mrs. Stewart, Freshfield, Liverpool, wife of the owner. The *Phosphor* is the first tank steamer built for Liverpool owners.

Petunia.—On Tuesday, January 29th, a party of ladies and gentlemen visited the works of the Blyth Shipbuilding Co., Limited, at Blyth, to witness the launch of a steel screw steamer of about 2,500 tons deadweight, named the *Petunia*. This vessel, which has been built to the order of Messrs. Lilly, Wilson & Co., West Hartlepool, is a fine specimen of a first-class cargo steamer. The vessel has been constructed with cellular bottom for water ballast, web frames, &c., and will class 100 A 1 at Lloyd's. She has a raised quarter-deck and poop aft, long bridge from after end of engine room to fore side of foremast, with topgallant forecastle for crew and firemen. There are four large cargo hatches, and four powerful steam winches from Messrs. R. Roger & Co., Stockton-on-Tees, for working the cargo. Direct-acting steam windlass is fitted by Messrs. Emerson, Walker & Thompson Bros., for working the stockless anchors, and Mr. Smiles' patent steam steering gear is fixed amidships, with a powerful screw gear aft. The engines are triple-expansion and will be supplied and fitted by Messrs. Black, Hawthorn & Co., Gateshead-on-Tyne, with cylinders 20 in. by 33 in., and 54 in. by 36 in. stroke, and 160 lb. pressure. As the vessel left the ways she was gracefully named the *Petunia* by Miss Wilson, daughter of one of the owners. This is the second vessel launched this year by the Blyth Shipbuilding Co., and who have several vessels in hand at present; they are also busily engaged in the construction of a large dry dock.

Dionysios Stathatos.—On January 30th there was launched from the shipbuilding yard of Messrs. John Readhead & Sons, West Docks, South Shields, a steel screw steamer of the following dimensions, viz., 280 ft. by 38 ft. by 18 ft. 9 in., and built under special survey to class 100 A 1 Lloyd's. The vessel is of the improved well-decked type, having poop, long raised quarter-deck, bridge, and topgallant forecastle. The vessel will be supplied by the same firm with triple-expansion engines, having cylinders 21 in., 35 in., 57 in. by 39 in. stroke, supplied with steam at 160 lb. pressure. The steamer has been built to the order of Messrs. Stathatos Brothers, of Ibrail and Sulina, and was christened the *Dionysios Stathatos* by Mrs. Varnekiottes, of South Shields.

Earnford.—On January 31st, at the shipbuilding yard of Palmer's Co., at Jarrow, a steel screw steamer was launched of the following dimensions:—Length between perpendiculars, 290 ft.; breadth, 39 ft.; moulded depth, 25 ft. 3 in. The vessel is rigged as a two-mast schooner, with square sails on the foremast, and is built to class 100 A 1 at Lloyd's, three-decked type. The upper and main decks are of steel throughout. A full poop is fitted aft, long bridge amidships covering machinery openings, and containing accommodation for captain, officers, and engineers, and a topgallant forecastle for crew and firemen. Water ballast is fitted all fore and aft on the cellular bottom system, and the vessel is divided in six compartments by watertight bulkheads. A complete set of shifting boards and grain feeders are fitted for grain cargoes, and a steam windlass is fitted on the forecastle deck. The vessel will load about 3,500 tons deadweight on a moderate draught. The vessel was named the *Earnford* by Miss Lucy Price, daughter of the general manager of Palmer's Co. The vessel has been built for the Earnline Steamship Co., Philadelphia.

Pocahontas.—On January 31st Messrs. Robert Stephenson & Co., Limited, launched from their shipyard, at Hebburn, a screw steamer for the Mediterranean and New York Steamship Co., of Liverpool and New York, of which Messrs. Phelps Brothers are managers. The dimensions of the vessel are as follows:—Length, 310 ft.; breadth, 39 ft.; and depth, 27 ft. 6 in. She is of the three-decked type, and has been built to take the highest class at Lloyd's. She will have a Board of Trade passenger certificate, and also an American passenger certificate. The hull is constructed entirely of steel. There is a cargo poop aft, and long bridge amidships, with cabins for captain, officers, and passengers. Being intended chiefly for the fruit trade, complete arrangements have been made for thoroughly ventilating the cargo hold, 15 patent ventilators being fitted with shafts communicating with the 'tween decks and lower holds. Five steam winches are placed at the hatches; there is a steam windlass on the forecastle, and steam steering gear is fitted in the wheel-house amidships. She will be fitted with triple-expansion engines capable of indicating about 1,400 H.P. The vessel was named the *Pocahontas* by Mrs. Alexander Hepburn, of Newcastle.

Dora Forster.—On Thursday, January 31st, there was launched from the works of the Tyne Iron Shipbuilding Co., Limited, a handsome steel screw steamer, of the improved well-decked type, built to the order of Messrs. Hunting & Pattison, of Newcastle and London. Her dimensions are:—Length 300 ft.; breadth 38½ ft.; depth 23 ft. 3 in.; and she will be fitted with powerful triple-expansion engines by Messrs. The North-Eastern Marine Engineering Co., Limited, of Wallsend-on-Tyne. She is fitted with all modern improvements for the rapid loading and discharging of cargo. On leaving the ways she was gracefully named the *Dora Forster* by Miss Pattison.

Lyonnesse.—On February 2nd there was launched from the yard of Messrs. Harvey & Co., Hayle, a screw steamship, built to the order of the West Cornwall Steamship Co., Penzance, for passengers and mail service between Penzance and the Scilly Islands. She is built of steel, and her length is about 180 ft. and breadth 25 ft., fitted with turtle back deck, long bridge, promenade quarter-deck, patent windlass, patent anchors, splendidly fitted saloons, fore-and-aft cabins, and triple-expansion engines, worked by two large steel boilers, working at high pressure. The ceremony of naming the vessel was performed by Mrs. Field, of Marazion, who named her the *Lyonnesse*.

Wm. C. Mitchell.—On February 2nd this vessel was successfully launched from the yard of Messrs. William Doxford & Sons, at Pallion. She has been built to the order of the Steam Navigation Co. of Ireland, of Belfast, for the general trades; is entirely of steel, and built to Lloyd's 100 A 1 class. The principal dimensions are:—265 ft. by 37 ft. by 18 ft. 6 in., with cellular double bottom fore and aft. The engines are triple-expansion, three crank, with all Messrs. Doxford's latest improvements, the cylinders being 21 in., 33 in. and 54 in. by 36 in. stroke, and they are supplied with high pressure steam from exceptionally large boilers. She is fitted with Bow McLachlan's patent steam steering gear and winches by Messrs. Welford Bros. of Pallion, with all the most recent improvements for cargo purposes. The cabins are most tastefully constructed in hardwood in the poop-aft, and afford most comfortable quarters for the captain and officers; engineers being berthed in bridge-house abaft the engine-room, and crew in front of bridge-house.

The christening ceremony was most gracefully performed by Mrs. Wm. C. Mitchell, the wife of the chairman of the company.

Steel Coaling Lighters.—On Saturday, February 2nd, there was launched from the shipbuilding yard of Messrs. Finch & Co., of Chepstow, three more 150-ton Steel Coaling Lighters, built to the order of the Lords Commissioners of the Admiralty.

Wild Flower.—On Saturday afternoon, February 4th, Messrs. Robert Thompson & Sons successfully launched from their Southwick yard the first vessel built on the Wear specially adapted for carrying petroleum in bulk, which class of vessel requires the workmanship and material to be of the very best description. The vessel has been built to designs specially prepared by the builders, and is of the following dimensions, viz.: —Length, 310 ft.; breadth, 40 ft. 2 in.; depth, 26 ft. 7 in. She is built on the spar deck rule to the highest class in Lloyd's, having seven hatches, and will be rigged as a three-masted schooner, and fitted with four powerful steam winches with large donkey boiler, derricks to load and discharge cargo from 'tween deck, a direct-acting steam windlass, and all the most modern improvements. The vessel has capacity for carrying 3,000 tons of oil, for which purpose she has been divided into six compartments transversely, and a longitudinal bulkhead along the centre of ship, each tank being capable of carrying about 500 tons, with six expansion tanks in 'tween decks. Great care has been taken in stiffening the bulkheads to withstand the very great pressure upon them, this being amply proved by the manner in which they stood the severe tests, not one of the tanks having to be filled a second time, and were all passed by Lloyd's and the owners' surveyors with entire satisfaction, the time occupied in filling and testing the whole of the oil compartments being only six days, which shows the care the builders have taken from the time the keel was laid until the finish, to give such satisfactory results. The pumping arrangement for the quick discharge of the oil, as soon as the vessel arrives in port, is provided by Messrs. Hayward, Tyler & Co., of London, who also fitted the electric light with which the vessel is lighted throughout. In addition to the oil compartment, there is a large ballast tank forward, and three tanks under the engines and boilers, so that the vessel may be easily trimmed as she burns out her bunker coal or oil fuel, of which, it may be mentioned, she has capacity for carrying 500 tons. The cabins are in the after end of the vessel, the crew being arranged for in the forecastle. The engines, of the triple-expansion type, are to be placed aft, and are by Mr. George Clark, Southwick, the sizes of the cylinders being 24 in., 39 in. and 64 in., and stroke 42 in. diameter. As the vessel left the ways she was gracefully christened the *Wild Flower* by the wife of Mr. E. A. Hayland.

LAUNCHES.—Scotch.

Arrow.—On January 26th there was launched from the Caledon Shipyard, Dundee (Messrs. W. B. Thompson & Co., Limited), a steel twin-screw steamer for the Shropshire Union Railway and Canals Company, of Chester. The vessel, which is called the *Arrow*, is of steel, and is of the following dimensions:—Length over all 108 ft.; beam, 21 ft.; depth, 7 ft. 8 in. She has been built beyond the requirements of Lloyd's highest class, and is fitted with two sets of triple-expansion engines, one for each screw. She is intended for towing and passenger trade on the Mersey, and with that view is fitted up with towing arrangements aft and large cabin forward; while above the house enclosing the machinery a spacious promenade deck has been built, from which the vessel is steered. Her engines (supplied from Messrs. Thompson's Tay Foundry) are of the triple-expansion type (W. B. Thompson's patent), fitted with hydraulic controlling gear. The cylinders are 9 in., 13 in., and 24 in. respectively, with a piston stroke of 14 in. A large steel boiler supplies the steam at a pressure of 150 lb. per square inch. Forward a combined steam winch and windlass is conveniently placed for working the anchors, boat, and derrick. Amidships all the space is occupied by machinery and coal, and the after-part of the vessel is fitted up for the crew, with separate rooms for captain and engineer. By means of the recently-elected travelling crane, Messrs. Thompson was able to launch this vessel complete with steam up, and (with the exception of the compass adjustments) in sailing trim.

Eden Vale.—On January 29th Messrs. S. M'Knight & Co.[s] shipbuilders, Ayr, launched from their yard an awning-deck steel screw steamer, built to the order of Mr. Joseph Wright, executor of the late Mr. John Bacon, Liverpool, for his passenger and cattle trade between Liverpool and Wexford. Dimensions:—Length, b.p., 180 ft.; breath, 27 ft.; depth of hold to awning-deck, 20 ft.; classed 100 A 1 in Lloyd's and to Board of Trade requirements for passenger service. The engines are triple-expansion, and will be supplied by Muir & Houston, Kinning Park, Glasgow. The vessel on entering the water was named *Eden Vale* by Mrs. Peacock (niece of the owner).

Lord Stanley.—On January 29th there was launched from the shipbuilding yard of Messrs. David & William Henderson & Co., Partick, a steel twin-screw tug, which has been built to the order of Mr. G. T. Davie, Quebec, and is intended for plying on the St. Lawrence. Her dimensions are 140 ft. by 24 ft. by 12 ft., with a gross tonnage of about 280 tons. She will be fitted with two sets of powerful triple-expansion engines, and all the latest improvements for a vessel of this type. On leaving the ways the tug was named *Lord Stanley* by Miss Haws.

Bombay.—On January 29th Messrs. Caird & Co., shipbuilders, launched from their yard a steel screw steamer of 3,400 tons gross, for the Peninsular and Oriental Steamship Co. As the vessel left the ways she was named *Bombay* by Mrs. Hall, wife of Mr. Hall, chief officer of the P. and O. steamship *Oriental*. The principal dimensions of the *Bombay* are:—Length, 350 ft.; breadth, 42 ft.; and depth 29 ft. 9 in. She has been built to Lloyd's three-deck rules for the 100 A 1 class, and her deadweight carrying capacity is about 4,900 tons on a draught of 24 ft. She has a straight stem and elliptical stern, and will be rigged as a double top-sail schooner. She is provided with a a topgallant forecastle and bridge-house, and when completed the latter will give accommodation for 22 first-class passengers. The vessel will be fitted throughout with the electric light, and ample provision has been made against fire. She will be supplied with steam steering gear, steam winches and windlasses, and all the latest improvements for discharging or loading cargo. The *Bombay* will be furnished by the builders with powerful engines on the inverted direct-acting triple-expansion principle, of about 2,000 indicated H.P. She has two double-ended steel boilers, and these have been constructed to sustain a working pressure of 180 lb. to the square in. The *Bombay* is the first of four large cargo steamers building by Messrs. Caird & Co. for the Peninsular and Oriental Co., and intended for the trade between Bombay and China. After the launch the *Bombay* was towed to the Victoria Harbour, where she will be fitted out for sea.

Singapore.—On February 2nd Messrs. Fleming & Ferguson, engineers and shipbuilders, Paisley, launched from their yard a steel screw steamer intended for passenger and cargo service between China and Singapore. This is the largest steamer yet launched on the Cart. Her dimensions are 275 ft. in length by 36 ft. beam. She will be fitted by the builders with their patent improved balanced quadruple expansion engines to indicate 1,600 H.P. As she left the ways she was named the *Singapore* by Miss L. R. Russell, Seaton Terrace, Glasgow.

J. H. Hustede.—On February 2nd Messrs. Russell & Co. launched from their east-end yard, Port Glasgow, an iron sailing barque of 1,170 tons gross register, to carry 1,900 tons deadweight. Her dimensions are:—Length, 215 ft.; breadth, 25 ft. 2 in.; depth, 21 ft. 2 in. This vessel was named *J. H. Hustede*, and has been built to the order of Mr. Joh. Hins. Hustede, Elsfleth, Germany. Immediately after the launch she was berthed at the steam crane in the East Harbour, where she will fit out. She will load coal at Cardiff for Esquimault, Vancouver Island.

Enterkin.—On February 2nd Messrs. Robert Duncan & Co., Port Glasgow, launched a steel sailing ship of 1,700 tons, for Mr. Thomas C. Guthrie's Village Line of sailing ships. The dimensions are 245 ft. by 39 ft. by 24 ft. moulded, and the vessel has been built to class 100 A 1 at Lloyd's, and carry 2,750 tons deadweight on Lloyd's freeboard. She is supplied with patent halyard winches for fore and main masts, patent windlass, arranged so that it can be driven from a powerful steam winch at mainhatch, patent main and bilge pumps, patent ventilators for holds, cabins, and deckhouses, and patent life-saving gangway and accommodation ladder combined. She was named the *Enterkin* by Miss Edmiston, Glasgow, and will be commanded by Capt. Logan, formerly of the *Bellona*.

Pegu.—On February 5th Messrs. William Denny & Brcs.

launched from their building yard at Dumbarton a steel screw steamship of the following dimensions:—360 ft. long, 45 ft. broad, and 29 ft. 11 in. deep; 3,800 tons gross register—built to the order of the British and Burmese Steam Navigation Co., Limited. On leaving the ways the vessel was named the *Pegu* by Miss Minnie Galloway, daughter of Mr. John Galloway, (of Messrs. P. Henderson & Co.), one of the directors.

Porro.—On February 18th the Grangemouth Dockyard Co. launched from their shipbuilding-yard, Grangemouth, a handsomely-modelled steel screw steamer, built to the order of Messrs. Willumsen & Jessen, Christiania, Norway, for their African trade. The dimensions are 180 ft. by 26½ ft. by 13 ft. 4 in. The vessel is being fitted up with all the latest improvements for working both ship and cargo. On taking the water she was named *Porro* by Mrs. Knudsen, wife of Captain Knudsen, who is to command the vessel. The vessel will be fitted at the Dockyard Co.'s works by Messrs. Hutson & Corbett, Kelvinhaugh Engine Works, Glasgow, with a set of triple-expansion engines of about 400 H.P., two steel boilers, 160 lb. working pressure, and three steam winches. The Dockyard Co. have at present two other steamers in hand for Norwegian owners, one of which is a passenger vessel for the Grangemouth and Christiania trade.

Hellopes.—On February 18th Messrs. J. Reid & Co., Port Glasgow, launched from their shipbuilding yard the steel screw steamer *Hellopes*, which has been built to the order of Messrs. R. P. Houston & Co., Liverpool, for their line of passenger and cargo steamers trading between Liverpool and the River Plate. The *Hellopes* has been specially designed for the conveyance of heavy machinery cargo, her cargo hatches being specially large. Her deadweight capacity is about 4,500 tons, and in addition to this, very ample saloon accommodation has been provided for passengers.

LAUNCHES.—Irish.

Star of England.—On February 2nd there was launched from the shipbuilding yard of Messrs. Workman, Clark & Co., Limited, Belfast, a steel screw steamer, called the *Star of England*, built to the order of Messrs. J. P. Corry & Co., Belfast and London. This is the second steamer built by Messrs. Workman, Clark & Co. for the above firm, the first being the *Star of Victoria*. As the steamer left the ways the ceremony of naming was performed by Miss Gotto. The dimensions of the vessel are:—Length between perpendiculars, 371 ft. 6 in.; breadth, 44 ft.; depth of hold, 27 ft. 2 in.; gross tonnage, 3,450, and carrying capacity of about 5,550 tons deadweight. She will be classed 100 A 1 at Lloyd's. The *Star of England* is built to the three-deck class, and has two complete steel decks. She is specially designed for carrying large cargoes of grain, shifting boards being fitted fore and aft between a double row of hold pillars. The ship is divided into eight watertight compartments by steel bulkheads, and has a double bottom on the cellular system. There are five cargo holds, with hatches of extra large size, and each hatch has a complete arrangement of steam winches and derricks for the rapid working of cargo. The windlass is driven by steam, as is also the steering gear. The last-named is placed on the upper deck at the after end of the engine-room. The *Star of England* will be rigged as a brigantine, her masts and yards are of steel, and fitted with all the latest improvements. The engines are of the triple-expansion design, and have been constructed by Messrs. J. & J. Thomson, Glasgow.

True Light.—On February 2nd there was launched at Arklow, a first-class fishing vessel called the *True Light*, one of four now building there, the money being lent by Government, built under special inspection of Board of Trade officers, by Mr. John Tyrrell, shipbuilder.

Sir Robert Fernie.—On February 19th Messrs. Russell & Co. launched from their Kingston shipbuilding-yard, Port Glasgow, a four-masted steel sailing barque of 2,400 tons nett register, of the following dimensions:—Length, 313 ft.; breadth, 42 ft.; depth, 24 ft. 6 in. Her carrying capacity is 4,000 tons. This vessel has been built to the order of Mr. W. J. Fernie, of London, and on leaving the ways she was named *Sir Robert Fernie* by a daughter of the owner. The *Sir Robert Fernie*, which will be commanded by Captain Cruickshanks, of Canada, will fit out in the James Watt Dock.

Lady Aline.—On February 20th Messrs. Russell & Co. launched from their Kingston shipbuilding-yard at Port Glasgow, an iron screw steam yacht, named the *Lady Aline*, which is of the following dimensions:—Length, between perpendiculars, 179 ft.; breadth, moulded, 24 ft. 6 in.; depth, 15 ft. 2 in. This vessel is of 520 tons (Thames measurement), and has been built to the highest class at Lloyd's. Messrs. William King & Co., Glasgow, will supply the engines, which will be on the triple-expansion principle, with cylinders 15½ in., 24 in., and 40 in. by 33 in. stroke.

TRIAL TRIPS.

Joseph John.—On February 1st this vessel, recently launched by Messrs. Wm. Doxford & Sons, of Sunderland, sailed from the Wear, to take her trial trip. The day was spent in trials on the mile at Whitley, when a speed of 11¾ knots was attained in ballast trim. She has been built to the order of Messrs. Jaffe Bros. & John Jaffe, Esq., of Belfast, and constructed under the supervision of Messrs. Carlisle & Co., of London, per Mr. C. P. W. Bond. After the trial trip the vessel proceeded direct to Antwerp. She is in every way a duplicate of the s.s. *Daniel*, recently built by Messrs. Doxford's for Otto Jaffe, Esq., Belfast.

Darial.—On January 24th the tank steamer *Darial*, lately launched from the Low Walker shipyard of Sir W. G. Armstrong, Mitchell & Co., was taken to sea on trial, her compartments being laden so as to immerse the vessel equal to her loaded conditions, in which she is capable of carrying over 4,100 tons deadweight. The vessel has been built to the highest class Veritas, and the arrangement of her tanks, &c., are on Swan's patent principle. The machinery is on the triple-expansion system, by the Wallsend Slipway and Engineering Co., and the boilers are fitted with mechanical draught, which on the trial worked in the most efficient manner. The *Darial* is the last of three sister ships built to the order of the Kerosene Co. of London. The *Darial* is fitted with the latest improvements, and everything throughout the trial worked in the most perfect manner, and on return to port the vessel at once proceeded to the Commissioners' spouts to take in her bunker coal, after which she proceeds on her first voyage to Batoum.

Echuca.—On January 25th the *Echuca* (s.) proceeded from the Tees on her trial trip. This vessel has been built by Messrs. Raylton, Dixon & Co., to the order of Mr. William Lund, of London, her dimensions being:—Length, 336 ft.; breadth, 40 ft.; depth, 28 ft. 8 in., with a deadweight carrying capacity of 4,050 tons, and is intended for his Australian line. She has accommodation for passengers in long poop aft, officers and engineers under long bridge amidships, and large chart-room and wheelhouse on top. Her engines, which have been built by Messrs. T. Richardson & Sons, Hartlepool, are 400 nominal H.P., having cylinders 27½ in., 43½ in., and 71 in. by 48 in. stroke, are very complete, and fitted with manganese bronze propeller. They worked satisfactorily on the trial trip, attaining a speed of over 12 knots with loaded vessel.

Start.—The screw steamer *Start*, a new vessel, 297 ft. by 40 ft. by 20½ ft., built by Messrs. Richardson, Duck & Co., of Stockton-on-Tees, for Messrs. Farrer, Groves & Co., of London, left the Tees for her trial trip. Her engines are of the triple-expansion type, of 200 H.P. nominal, having cylinders 22½, 37, 61, by 42 in., working at 160 lb. pressure of steam, built by Messrs. Blair & Co., Limited, of Stockton-on-Tees. She made a most successful trip, everything working in first-class style. The vessel attained a speed of 12 knots per hour.

Banks Peninsula.—On January 26th the new steel twin-screw steamer *Banks Peninsula*, recently launched by the Grangemouth Dockyard Co., went down the Firth of Forth on her official trial trip. Over the measured mile the vessel attained the speed of 12 knots an hour. The machinery worked smoothly throughout, and the trial went off without the slightest hitch. The *Banks Peninsula* has been specially built for the passenger and cargo trade on the coast of New Zealand, and it is fitted up with all the latest improvements. The engines, which are of the compound surface-condensing type, were supplied by Messrs. Hutson & Corbett, Kelvinhaugh Engine Works, Glasgow, and she is fitted with Wrench's patent propellers. The vessel has been built to the order of the Akarreo Steam Navigation Co., Lyttelton, New Zealand. The vessel returned to Grangemouth in the evening to load for Lyttelton.

Hindoo.—On January 26th the steamship *Hindoo*, built and engined by Messrs. Robert Stephenson & Co., Limited, of Newcastle-on Tyne, to the order of Messrs. Thomas Wilson, Sons & Co., of Hull, left the Tyne for her official trial, consisting of a run over the measured mile, and a trip to Hull. The *Hindoo* is of the following dimensions:—Length, 369 ft.; breadth, 42 ft. 10 in.; depth, 30 ft. 4 in. The engines are of the triple-expansion, direct-acting type, with cylinders 27 in., 43 in., and 70 in. diameter respectively, and 48 in. stroke. There are two double-ended steel boilers, 14 ft. 2 in. in diameter, and 16 ft. 6 in. long, fitted with Fox's corrugated furnaces and Henderson's patent firebars. The engines are fitted with a feed heater and evaporator, for supplying the boilers with fresh water. The ship is lighted throughout by electricity, and has powerful electric lights for discharging cargo, and for use when passing through the Suez Canal by night. The vessel was loaded with 4,000 tons, and attained a speed of 11¼ knots over the measured mile. The voyage to Hull was accomplished at full speed to the satisfaction of the owners' representatives. The steamer has been built to Lloyd's and the Board of Trade passenger certificate.

Blakemoor.—On January 28th the new screw steamer *Blakemoor* was taken to sea on her trial trip. This vessel has been built by Messrs. John Readhead & Sons, West Docks, Shields, for Messrs. Walter Runciman & Co., South Shields, and is of the following dimensions, viz.:—259 ft. by 36 ft. by 19 ft.; is of the improved well-decked type. She is classed 100 A 1 at Lloyd's, special survey, and is fitted up with all the latest appliances, and to comply with the Grain Cargoes Act. The engines are of the triple-expansion type, having cylinders 20½ in., 33½ in., 55 in. by 36 in. stroke, and are supplied with steam from two large steel boilers at a pressure of 160 lb. per square in. The vessel made several runs on the measured mile and along the coast, and the mean speed obtained was 11 knots per hour. The *Blakemoor*, after her return to the harbour, proceeded to Hebburn spouts to load a cargo of coal for Naples.

Pretoria.—On January 28th the Union Co.'s Royal Mail steamer *Pretoria*, having completed a thorough refit, and her engines converted to the tri-compound system, with new high-pressure boilers working at 160 lb. to the square in., underwent her official trial trip in Stokes Bay, when she obtained a mean speed of 14.326 knots per hour, and indicated 3,657 H.P. This is an increase of three-quarters of a knot, and 861 H.P. over the result of the trial trip with the old type engines.

Conde Wifredo.—On February 6th the steamship *Conde Wifredo* left the Wear for her trial trip on the measured mile off Whitby. She has been built by Messrs. J. L. Thompson & Son, North Sand shipyard, to the order of a Spanish firm, Senores, Pinillos, Saens y Cia., of Barcelona. Her dimensions are:—Length over all, 390 ft.; breadth, 44 ft.; and depth moulded, 30 ft. 2 in. The vessel has three complete decks, two of which are of steel, covered with yellow pine, and six steel bulkheads. She has been constructed on the cellular and solid floor principle to class 100 A 1 at Lloyd's, and is certified by the Board of Trade for passengers and Suez Canal service. The engines, on the triple-expansion system, have been built by Mr. John Dickinson, Palmer's Hill Engine Works. The three cylinders, 31 in., 51 in., and 83 in. respectively, have a stroke of 54 in. There are six boilers, multitubular in form, and constructed of steel for a pressure of 160 lb. to the square in. The engines will, it is anticipated, indicate about 3,000 H.P. The trial was of a most satisfactory character, a speed of 14½ knots being attained on the measured mile.

Iago.—On February 13th the *Iago* (s.), which has been built by Messrs. Raylton, Dixon & Co., of Middlesbrough, for Messrs. Thos. Wilson, Sons & Co., Hull, took her trial trip from the Tees with satisfactory results. The dimensions of this vessel are:—Length, 304 ft. 3 in.; breadth, 38 ft.; depth, 22 ft. 10 in.; with a deadweight carrying capacity of 3,600 tons. She is built on the well-decked type. Her engines are of 210 nominal H.P., with cylinders 23 in., 37 in., and 61 in. by 42 in. stroke.

Otter.—Messrs. Wm. Simons & Co., of Renfrew, invited a number of gentlemen to witness the trial of the new patent hopper dredger *Otter* at Cessnock Dock, Govan. The *Otter* was brought up from Renfrew in the morning and moored near the entrance to the dock. There was a heavy swell on the river, and the trial could not come off owing to a barque drifting from her moorings and blocking the entrance to the dock. The *Otter*, which is the first of a new type of dredger, is 170 ft. long, with a breadth of 32 ft., and 14 ft. depth. In the forward part are fitted two pairs of independent compound surface-condensing engines of 500 I.H.P., each pair driving its own line of propeller shafting. The dredging operations can be carried on by either pair of engines, and each would be capable of raising 400 tons of ordinary material per hour. By means of Brown's patent traversing gear—an important improvement developed by this firm—the bucket ladder can be moved forward or backward independently of the vessel, and thus be made to project through the stern of the vessel and cut its way into and through sandbanks where there would not ordinarily be sufficient water to float in. But the point of difference between this one and other dredges is not in the application of the traversing gear, but in the stern being divided instead of the base for the projection of the bucket ladder, and in this manner having a solid instead of a divided bow, and being thus better able to withstand heavy seas. In the suspension of the bucket ladder another improvement has been effected by hanging the bucket ladder on a separate shaft from that which holds the top tumbler, so that the latter may be taken out without having to disconnect the lower tumbler. Spring buffers are fitted at the top bearings of the bucket ladder, so that when rising and falling in a swell the risk of breakage to the ladder shaft bearings is reduced to a minimum. The buckets have a capacity of half a ton each, and are a decided improvement in form upon those hitherto in use. Ripping claws are provided for the disintegration of hard material. The dredger has been built for the Natal Harbour Board, for whom Messrs. Simons & Co. have a second on order.

Adelalde Lavarello.—On January 19th this steel screw steamer, which has been specially built and engined by Messrs. Wigham, Richardson & Co. to carry emigrants between Genoa and Montevideo, had a successful trip. She had a progressive trial, consisting of a series of runs at different speeds over the measured mile. On the full speed runs a mean of over 15 knots per hour was attained, which result is highly satisfactory. The engines (Tweedy's triplex expansion) worked with the most perfect smoothness throughout.

Reviews.

The Model Engineer's Handy-book. By Paul N. Hasluck. London: Crosby Lockwood & Son.

Mr. Hasluck has written many useful "handy-books," and to those of our readers who may be ambitious to construct a miniature reproduction of any machinery with which they are acquainted, this, his latest literary effort, cannot but prove both useful and interesting—useful because model engineering is a branch of the mechanical arts that has received but a scanty share of literary treatment, and interesting because of the very thorough manner in which the author has performed his task.

Carefully written as the book is, its value is decidedly enhanced by the large number of carefully engraved illustrations with which it is provided, and as these are accurately reduced from working drawings of model engines that have been constructed under the author's own supervision, they will be appreciated by those who are interested in models of the kind they represent.

If we might express a wish, it would be that Mr. Hasluck should write more on the same subject.

Adams's Southampton Household Almanack for 1889. Southampton: John Adams & Sons.

We have now before us the 35th issue of this most useful annual, which well sustains the reputation achieved by its predecessors for fulness and variety of information.

Needless to say, the contents of that part of the present almanack which treats of the tide and nautical tables, and the year-book of useful information have been thoroughly revised and brought down to date.

The "Annual Retrospect" is very interesting, and shows that the "good old town" of Southampton is quite capable of taking care of itself and the interests of its inhabitants, so far as improvements of one sort and another can go.

Full information is given as to the docks, rates, dues, pilotage, &c., and, in fact, nothing that could have served to enhance

the usefulness of the book appears to have been omitted, and to this may be attributed the more than local patronage the book has for so many years enjoyed.

Recent applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from January 14th to February 9th, 1889.

674 J. Robinson & W. Summers. Piston rings.
743 De Pass (V. C. Ferré). Swimming and safety vests.
750 F. W. Brewster. Life-saving buoys.
766 A. Ashton. Lifeboats.
820 J. Gibson. Bell buoys.
832 H. Schneider. Controlling recoil of guns.
855 O. Richter. Valves.
877 W. Verner. Magnetic and sight compass.
901 Imray (J. Gräbner & H. Ruperti). Cylinders and pistons.
902 M. Tweedie. Compound projectiles.
921 R. Lindner. Starting gears for compound engines.
929 G. T. Barlow. Fastening the stock of anchors.
930 J. Brown. Continuous tube steam boiler.
944 R. J. Paris. Metallic packing.
953 A. B., J., P., & J. Jardine. Tube expanders.
1024 J. M. B. Baker. Removing sandbanks in tide-ways.
1036 N. S. Hawks. Pump buckets.
1078 H. & A. Green. Purifying water and removing crustation from steam boilers.
1149 P. Charles. Propelling vessels.
1162 R. Kennedy. Governor for steam-engines.
1195 C. Dann. Torpedo dropping gear.
1197 A. C. Barbaran. Masking torpedo boats.
1219 J. Tidswell. Corliss engines.
1223 E. Berg. Reply telegraphs for engine-rooms.
1277 N. C. Bing. Distributing oil on troubled water.
1310 N. S. Parker, W. Mahood, and A. Granville. Shafting for steamships.
1331 T. Cooper. Surface condensers.
1353 J. F. Wall & J. Verity. Anchors.
1382 P. J. Ogle. Suction dredgers.
1464 T. T. Cowell. Steam engine packing.
1509 F. W. Brewster. Life-saving buoys.
1522 W. Clucas. Surf boat.
1544 R. W. & W. R. Tayler. Tube expanders.
1546 J. F. Ryan. Steering-gear.
1549 P. R. Bjsorling. Valve gear.
1551 W. Brierley. Water-level indicator.
1704 H. B. Barlow & J. J. Dack. Transferring vessels across a waterway.
1720 W. Head & R. Barnard. Capstans.
1723 H. A. Entwisle. Centrifugal pumps.
1750 T. Shepherd & E. H. Dee. Chocks for rowlocks.
1754 Jron Peichl. Correcting ships' compasses.
1760 E. Agatz. Cleaners for ships' bottoms.
1793 A. H. Wallis. Starting and stopping gear for engines.
1831 Thompson (P. & V. Caillard). Slide valves.
1847 E. Harrison. Preventing incrustation in steam boilers.
1852 F. W. Jones. Loading and unloading ships.
1887 Mills (J. L. Hornig). Steering apparatus for vessels.
1910 R. Marggraff. Speed governor for motors.
1966 D. Morison. Transhipping coal.
1999 H. Thorne. Expansion engines.
2032 E. Acheson. Preventing barnacles adhering to ships bottoms.
2076 J. Latham. Signalling on board ships.
2113 C. Inwood. Screw propellers.
2157 Thompson (A. Junlor). Propulsion and steering of vessels.
2233 A. C. A. Holzapfel. Ships.
2253 W. Park. Stop-valve for steam.
2294 D. Campbell, G. L. Schultz, & S. J. Fellows. Shells for buoys.
2309 W. Ford. Recording speed of projectiles.
2356 J. R. Holmes. Inextinguishable lights on ships.
2361 R. F. Ward. Raising sunken vessels.
2362 Ditto. Ditto.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1 C, denotes First Class; 2 C, Second Class.

February 2nd, 1889.

Arthur, Thos...	2C	Glasgow
Baker, James..	1C	Belfast
Brown, Robt. S.	1C	Glasgow
Caldwell, David	2C	,,
Clegg, James H.	1C	Liverpool
Crichton, W. G.	1C	,,
Dutton, J. G. ..	1C	London
Elliott, Robert	1C	Glasgow
Fenton, John ..	2C	Liverpool
Gillespie, Andw.	1C	Glasgow
Glazebrook, W.P.	1C	London
Haigh, James W.	2C	Liverpool
Hill, Arthur E.	1C	London
Jeffares, Richd.	2C	Liverpool
Kerr, Peter	1C	Glasgow
Kidd, G. C.	1C	Liverpool
Law, John	2C	Liverpool
Laurie, Peter S.	2C	London
Moffat, James ..	2C	Glasgow
McMillan, Hugh	1C	,,
Muirhead, Jas.	2C	,,
Pinnington, W.H.	1C	London
Ritchie, Thos. C.	2C	Glasgow
Robinson, H. D.	2C	Liverpool
Stowe, Geo. S.	1C	London
Taylor, E. R. ..	2C	,,
Tod, Andrew W.	1C	Liverpool
Walls, Wm. C.	1C	,,
Whitson, Alex...	1C	London

February 9th, 1889.

Alexander, C. W.	1C	Leith
Anderson, W. T.	2C	Liverpool
Bill, Wm. A. ..	2C	Leith
Blyth, James ..	2C	,,
Braidwood, T. A.	1C	,,
Buchanan, D...	2C	Hull
Burnett, Wm...	1C	Liverpool
Butler, James..	2C	Leith
Butterell, Eli ..	2C	Hull
Couper, Thos...	2C	Greenock
Dallas, James..	1C	Liverpool
Davies, William	2C	,,
Faulkner, G. V.	1C	London
Fergusson, Geo.	2C	N. Shields
Hood, John ..	2C	Leith
Halliday, J. R.	2C	Greenock
Harper, Thos...	2C	N. Shields
Harris, Samuel	2C	Liverpool
Harrison, Wm.	2C	Hull
Jackman, A. B.	2C	Greenock
Jeff, Richard ..	1C	London
Jolly, Robt. J.	1C	Leith
Laing, William	2C	N. Shields
MacGregor, R.	2C	Leith
McGill, William	2C	Greenock
McLellan, John	1C	,,
Moffatt, D. T.	1C	Liverpool
Miller, John ..	1C	Greenock
Morrison, John	1C	,,
Newby, Thomas	2C	N. Shields
Nicol, Andrew	2C	,,
Robb, Alexer...	2C	Dublin
Ross, James ..	1C	Greenock
Scott, John F.	1C	N. Shields
Stewart, E. A.	1C	London
Thomas, A. G.	2C	Liverpool
Tod, John	1C	Dublin
Tough, George	2C	Leith
Turnbull, Thos.	1C	N. Shields

February 16th, 1889.

Bird, John	1C	N. Shields
Broadbent, Eli A.	1C	Liverpool
Brown, Wm. ..	2C	Dundee
Craig, Horatio	1C	Liverpool
Crawford, G. A.	2C	N. Shields
Davidson, Wltr.	2C	,,
Davison, John B.	2C	London
Donkin, Robert	2C	W. Htl'p'l
Forrest, Robert	2C	N. Shields
Fray, Robert ..	2C	W. Htl'p'l
Greig, William	1C	Dundee
Gayes, Thomas	1C	Liverpool
Hetherington, J.	2C	,,
Horne, Thos. H.	1C	Dundee
Jacques, J. L. ..	2C	W. Htl'p'l
John, Thos. M.	1C	London
Jones, Henry ..	2C	N. Shields
Jones, William	2C	W. Ht'l'p'l
Kennedy, D. ..	1C	Greenock
Mackintosh, W.	2C	Leith
Manson, James	1C	N. Shields
Pile, William ..	2C	,,
Spalding, James	2C	Dundee
Scurr, Alf. V. ..	2C	W. Ht'l'p'l
Simpson, A. E.	2C	,,
Thomson, C. L.	2C	Dundee
Thorman, Chas.	2C	W. Ht'l'p'l
Triplet, Sidney	2C	Plymouth
Wilkinson, M. L.	2C	N. Shields

Miscellaneous.

YACHT "SAIDE," LATE "STAR OF THE SEA."—This magnificent 400-ton auxiliary composite steam yacht, lately bought by Mr. Miller, of Australia, from the Duke of Norfolk, left Leith on 7th February for Port Darwin, North Australia, *via* Suez Canal and Colombo. This yacht has been in the hands of her builders, Messrs. Ramage & Ferguson, being altered and refitted for her long voyage, and many improvements have been carried out. The masts have each been shortened 8 ft., and square rig forward has been adopted, besides which a new patent bevis shaft feathering bronze propeller has been fitted. The *Saide* carries a crew of 20 all told, most of the sailors hailing from the fishing village of Newhaven, near Leith. Being of composite build and coppered on the bottom, this yacht is specially well adapted for cruising in Eastern waters. A party of yachtsmen sail as far as Plymouth in her, amongst whom are Mr. Chas. Temperley, of Newcastle, Mr. J. Ferguson, of Messrs. Ramage & Ferguson, the builders; Mr. Patrick Rattray, Glasgow; and Dr. Barnett.

HIGHEST AWARD
GOLD MEDAL.

M. HOLZAPFEL & CO.,

QUAYSIDE,

NEWCASTLE-ON-TYNE,

Manufacturers and Sole Proprietors of the

International Exhibition,
CALCUTTA, 1884.

INTERNATIONAL ANTIFOULING COMPOSITION

Colour and appearance same as "RAHTJEN'S PATENT" COMPOSITION, but the INTERNATIONAL is much STRONGER and more EFFECTIVE as an ANTIFOULER.

NATIONAL ANTIFOULING COMPOSITION,

Specially prepared for North Atlantic, Baltic, and Home Trades.

Contractors to—
H.M. GOVERNMENT.
The INDIAN GOVERNMENT.
The AUSTRALIAN GOVERNMENTS.
The IMPERIAL AUSTRIAN GOVERNMENT.
The IMPERIAL TURKISH GOVERNMENT.

TRADE

MARK

Contractors to—
The IMPERIAL GERMAN GOVERNMENT.
The ROYAL ITALIAN GOVERNMENT.
The CONGO FREE STATE (Vivi), &c., &c.

Contractors by Royal Decree to
The ROYAL SPANISH GOVERNMENT.

HOLZAPFEL'S PATENT SOAP STONE COMPOSITION,

The most reliable Paint against atmospheric influences. The cheapest and best protective Paint manufactured.

QUICK DRYING. READY FOR USE. PRICE 30s. PER CWT.

MANUFACTURERS OF

GENUINE "RAHTJEN'S PATENT" COMPOSITION,

Supplied at Considerably Reduced Prices. Warranted made according to Rahtjen's Original Specification.

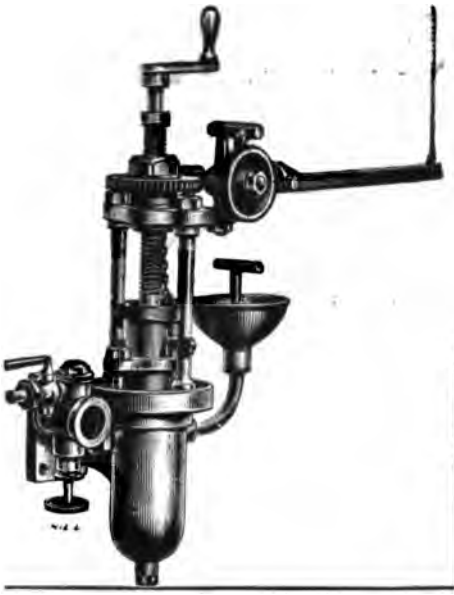
AGENCIES AT PRINCIPAL PORTS AT HOME AND ABROAD.

HIGHEST AWARD:
SILVER MEDAL.

BRANCHES AT—

CARDIFF - Holzapfel, Petri & Co. 43, Mount Stuart Square
LIVERPOOL Holzapfel & Co. - 3, Chapel Street.
GLASGOW - Holzapfel & Co. - 12, Waterloo Street.
LONDON - Holzapfel & Co. - 116, Fenchurch Street.

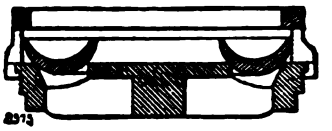
International Exhibition
Crystal Palace, 1884.



Vulcan Automatic Sight-Feed Lubricator.

ADVANTAGES.

1. It saves 50 to 75 per cent. in Oil.
2. Saves Packing.
3. Cylinder and Valves are supplied with Oil regularly and efficiently.
4. Can never get out of order.
5. Reduces friction by constant and regular lubrication, which means fuel saved and irregularity in running avoided.
6. Wear and tear of Engine reduced to a minimum.
7. Requires no attention, only filling every watch (4 hours).
8. Is Automatic in its working, the Piston standing still on reaching the bottom.
9. By aid of the Sight-feed it can be seen at a glance whether the Lubricator is doing its work.
10. Cheapness.

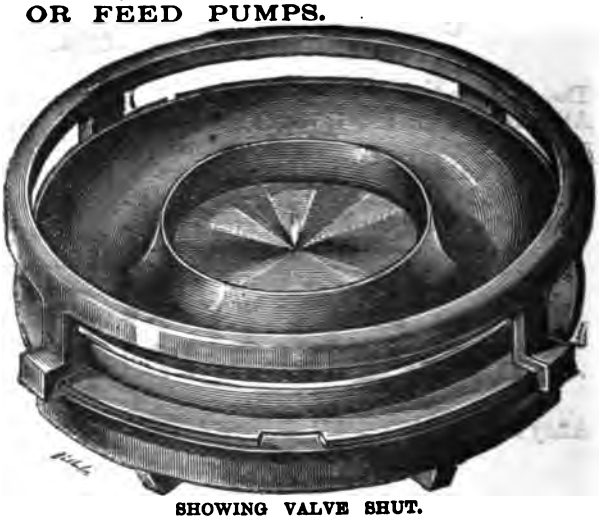


REID'S SPINDLESS METALLIC VALVE.

(Patent Nos. 2,869 and 1,172.)

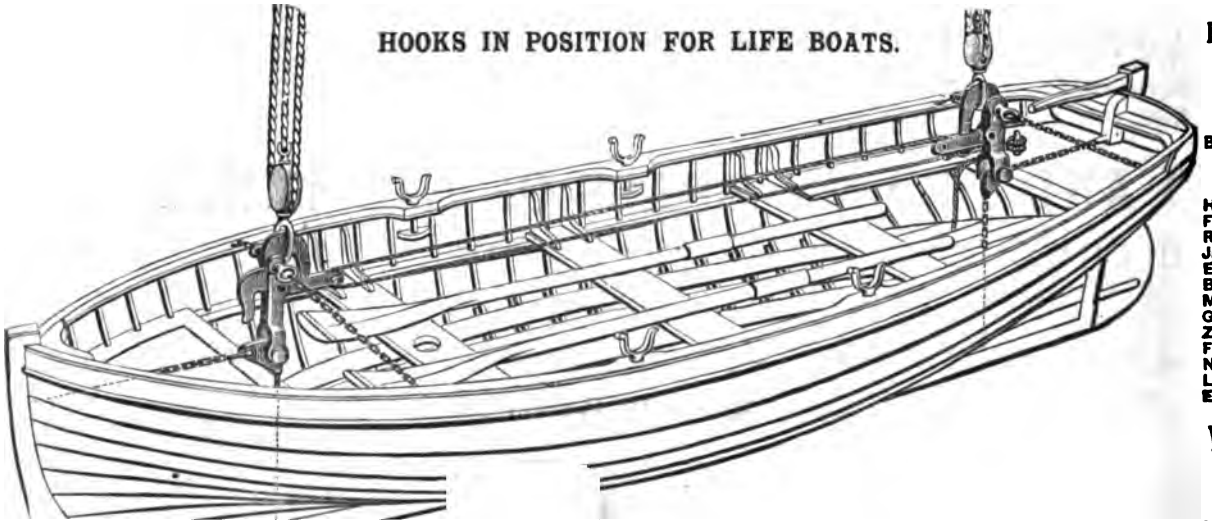
FOR AIR, CIRCULATING OR FEED PUMPS.

SHOWING VALVE OPEN.



SHOWING VALVE SHUT.

ADVANTAGES.—Is self-contained and has no spindle or screws, therefore not liable to stick or get out of order. Will work equally well horizontally or vertically. Will allow more water or other liquid to pass through than any other, as it has two distinct openings or outlets (see view showing valve open). Valve can be reversed by taking off guard which will alter the lift.



HOOKS IN POSITION FOR LIFE BOATS.

REES'
BOAT DISENGAGING HOOKS.

Effective! Simple! Cheap!!!

APPROVED OF BY
BOARD OF TRADE EMIGRATION OFFICERS. &c

SUPPLIED TO

H.M. Navy.
Fairfield Engine Co.
Rayton, Dixon & Co.
James Laing.
Eastern Telegraph Co.
British India S. N. Co.
McGregor, Gow & Co.
Geo. Thompson & Co.
Zealand S.S. Co.
French Transatlantic Co.
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London, C. and D. Railway
Earle's Shipping Co.,
etc., etc.

WILLIAM REID & CO.,
45, Fenchurch St.
LONDON, E.C.

THE PHOSPHOR BRONZE Co.,
LIMITED.

87, SUMNER STREET, SOUTHWARK, LONDON, S.E.

Rolling and Wire Mills: BAGOT STREET, BIRMINGHAM.
Show Rooms: EXCHANGE BUILDINGS, BIRMINGHAM.
Branch Foundry: 18—22, LITHERLAND ALLEY, LIVERPOOL.

Sole Makers of the Renowned **"COG WHEEL" Brand of**

"PHOSPHOR BRONZE" Alloys,

The best and most durable Metal for Bearings, Bushes, and parts of Machinery exposed to friction and wear. Alloy Nos. I, II, III, IV, V, VI, VII, VIII, IX, X, and XI, Special Bearing Metal. All Ingots bear the full name of the Company, the Registered Trade Mark, a "COG WHEEL," and the distinguishing number of the Alloy. To avoid error or imposture, please specify the Manufacture of the PHOSPHOR BRONZE COMPANY, LIMITED, LONDON, or the "COG WHEEL" Brand, as well as the number of the Alloy required. Nos. II, III, V, VII, and XI are the Alloys mostly used. For particulars see Circulars.

"DURO METAL,"

(REGISTERED TRADE MARK).

Alloy A, for RAILWAY CARRIAGE, WAGGON, and TRUCK BEARINGS. Alloy B, specially adapted for BEARINGS for HOT NECK ROLLS of IRONWORKS, TIN-PLATE MILLS, &c.

PATENT SILICIUM BRONZE WIRE

For OVERHEAD TELEPHONE, TELEGRAPH, and ELECTRIC LIGHT LINES, as used by most Telephone, Railway, and Electric Light Companies. High conductivity, great tensile strength, and resistance to corrosion. Sole Proprietors of the Patents for the United Kingdom, India, and all British Colonies and Dependencies.

ROLLED AND DRAWN BRASS OF ALL KINDS;
HIGH CONDUCTIVITY & OTHER COPPER WIRE.

Genuine Finest Babbitt Metal, "Vulcan" Brand. Plastic Metal, "Cog Wheel" Brand.
"Phosphor" White Brass. Phosphor Tin, "Cog Wheel" Brand.

DAVIS'S PATENT STEERING GEARS.

GOLD MEDAL—International Exhibition, Amsterdam, 1883.

Davis's Patent Steam and Hand Combined Steering Apparatus.

As supplied to S.S. "Faraday," "S.S. "Hooper," Her Majesty's Government, Sir W. Armstrong, and other well-known firms.

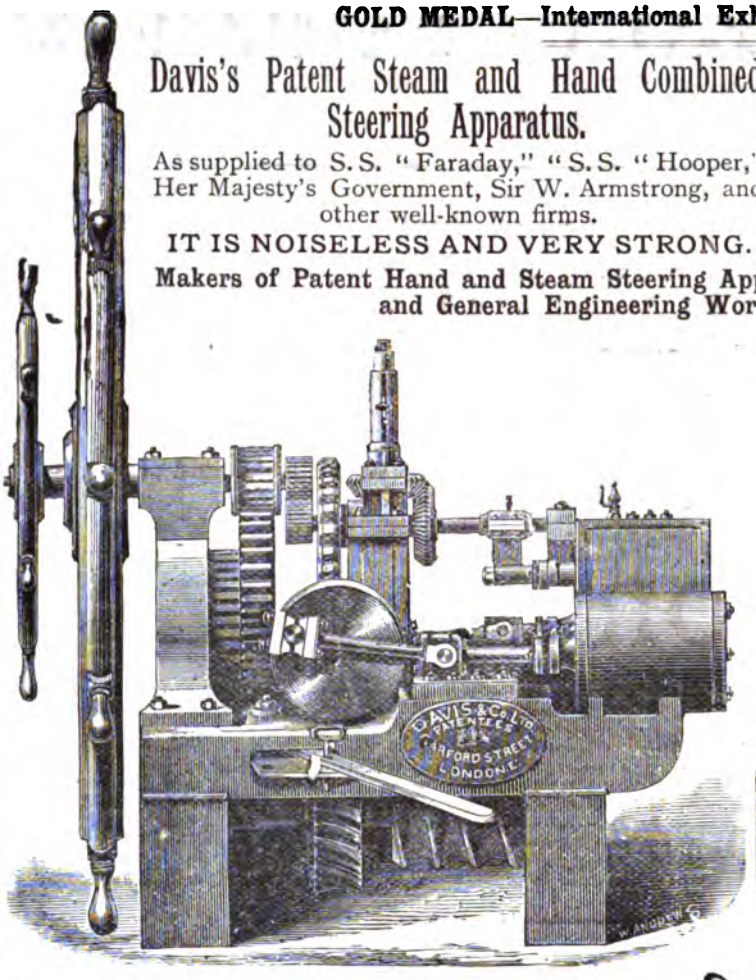
IT IS NOISELESS AND VERY STRONG.

Davis's Patent Hand Steering Machine.

Fitted to most of the large lines of Steamers.

Owing to its being a worm and worm wheel motion, the steering wheel does not kick when a sea strikes the rudder, which is a great gain. There are also no leading blocks in the machine.

Makers of Patent Hand and Steam Steering Apparatuses, Capstans, and General Engineering Work.

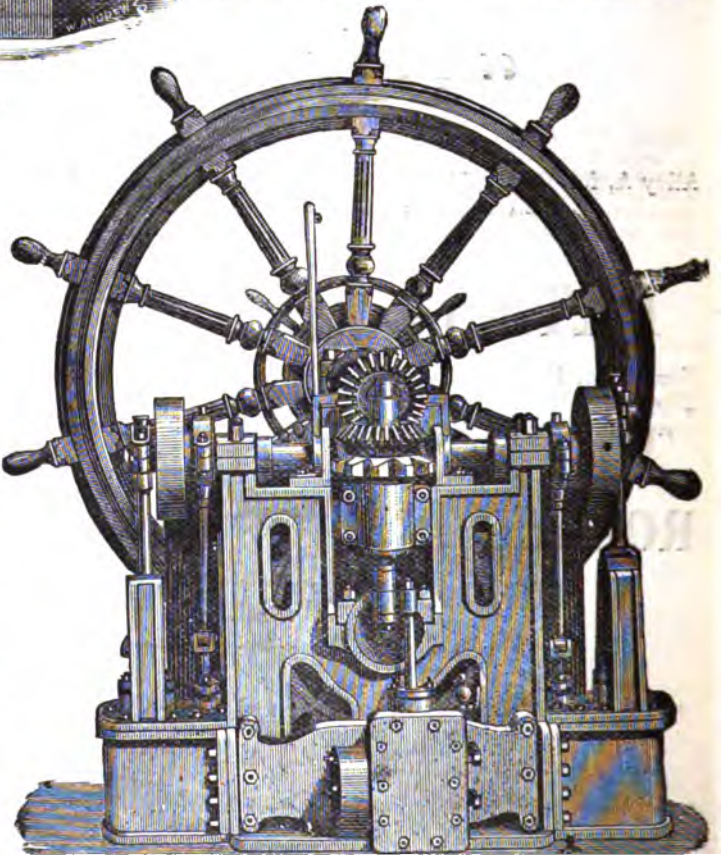


PATENT VERTICAL HAND & STEAM-COMBINED STEERING MACHINE,

Suitable for Steamers where the Steering Room is small.

Dimensions fore and aft 2 ft. 4 in. by 3 ft. 6 in. athwartships, without Steering Wheels, for a 2,000 tons Steamer.

Fitted to over 800 Steamers of all tonnage, including Tugs and Yachts.



DAVIS & Co., Limited,

Garford Street Engineering Works,

WEST INDIA DOCK ROAD,

LONDON, E.

TUCK'S TRIPLE PACKING.

(MORISON'S PATENT.)

THE ONLY RELIABLE PACKING

FOR

TRIPLE EXPANSION ENGINES

EXTRACTS FROM TESTIMONIALS:

GREAT WESTERN STEAM SHIP LINE,
BRISTOL, *Aug.* 10th, 1887.

DEAR SIRS,—With regard to your enquiry respecting the performance of your Triple Packing fitted to the engines of the *Worcester*, I beg to state that it has run three Atlantic voyages, and given entire satisfaction in this Steamer.

Yours truly,
R. I. CROSS, *Supt. Engineer.*

S.S. *Brampton*,
NEWPORT, *December 1st*, 1887.

Messrs. TUCK & Co.

DEAR SIRS,—With reference to your letter of enquiry about the Triple Packing you supplied to the above Steamer, I have waited until the ship finished her second voyage before giving you an answer.

Your packing was put in the H.P. piston slide valve and H.P. piston glands 26th May, 1887, at Penarth. The ship went out to Colombo, and from there to three ports on the Madras coast, thence to Marseilles, from Marseilles to Odessa, and back to Fleetwood and Newport, and after being in the glands for over 7 months, and running 10,635 miles, I find it still in good condition.

I can, therefore, with confidence recommend it as a good and reliable packing for high-pressure engines. Our boiler pressure is 160 lbs. per square inch.

I beg to remain, DEAR SIR,
Yours respectfully,
G. A. STRONG, *Supt. Engineer.*

S.S. *Enfield*, PENARTH DOCK,
January 24th, 1888.

Messrs. TUCK & Co.

DEAR SIRS,—We have given your Triple Packing a fair trial. Having steamed over 10,000 miles, I can say without hesitation that it is the best Triple Packing that I have ever used. We packed our H.P. piston rod gland 3½ months ago, and have added two turns since that late. Our pressure is 160 lb.

(*Signed*) C. H. HUNTER, *Chief Engineer.*

S.S. *Shakespear*, CARDIFF,
January 31st, 1888.

Messrs. TUCK & Co.

GENTLEMEN,—I have much pleasure in stating that your Triple Expansion Packing (Morison's) is giving every satisfaction. The H.P. piston rod gland was packed on 28th April last, and has only just been repacked—the 20th instant—having run 38,500 miles. The H.P. valve spindle is also packed with it, and doing very well, but does not run quite so long. I am sure any engineer once trying your packing will not fail to come back to you again.

I am, GENTLEMEN,
Yours respectfully,
(*Signed*) HENRY J. CHARTERS.

LIVERPOOL, *26th June*, 1888.

Messrs. TUCK & Co.

DEAR SIRS,—Having experienced your Triple Packing (Morison's Patent), I am pleased to say, without doubt, it is the best that can be had for high pressures.

It has been used in the steamer *Rubens*, ever since the vessel was new, now ten months, and has given great satisfaction.

Two successive voyages have been made to China ports and back to Liverpool. Long voyages prove the virtue of this Packing; stoppages at sea are prevented; the piston-rods and valve spindles are kept uniform and in good condition. Our working pressure is 160 lbs. per square inch.

Yours truly,
(*Signed*) W. T. STEWART.

DUNDEE, PERTH AND LONDON SHIPPING COMPANY,
NEW DUNDEE WHARF,
273, WAPPING,
LONDON, E., *28th August*, 1888.

GENTLEMEN,—I have had in use your Triple Expansion Packing working in our H.P. engine for a period of ten months, trading between Dundee and London once a week. During all that time it has given every satisfaction. Our pressure is 165 lbs., and the average revolutions are 78 per minute.

Yours very truly,
(*Signed*) PETER McFARLAN,
Chief Engineer, S.S. *Dundee.*

TUCK & Co., LIMITED,

SOLE MANUFACTURERS OF THE ABOVE; ALSO OF

TUCK'S GENUINE PACKING,

TUCK'S PURE ASBESTOS, AND TUCK'S METALLIC PACKING,

India Rubber Goods of all Descriptions,

LEATHER BELTING, HOSE, &c.

LONDON:	LIVERPOOL:	CARDIFF:	NEWPORT:	SOUTHAMPTON:
116, Cannon Street.	**42, Chapel Street.**	**103, Bute Docks.**	**Alexandra Dock.**	**Richmond Place.**

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FROST BROTHERS,

ROPE MANUFACTURERS,

Contractors to the Peninsular and Oriental Steam Navigation Co.
Royal Mail Steampacket Company. General Steam Navigation Co.
Shaw, Savill & Albion Co. New Zealand Shipping Co. North German Lloyds.
And many other leading Steamship Companies.
Hon. Corporation of the Trinity.
London & North Western Railway, Great Northern Railway,
London, Brighton & South Coast Railway Co., London, Chatham & Dover Railway Co.,
And other English and Foreign Railway Companies.

City Office: 11, LONDON ST., FENCHURCH ST., LONDON.

LINES OF EVERY DESCRIPTION FOR STEAMERS.

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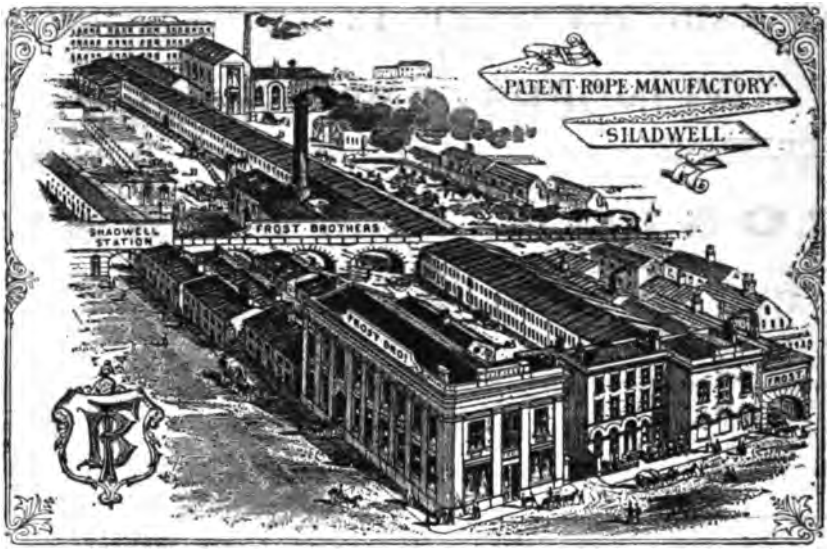
OAKUM.



ENGINE PACKING.

—

MANILLA MAIN DRIVING ROPES.

Works and Warehouse—SHADWELL, LONDON, E.

ROPE AND HAWSERS
IN MANILLA, TARRED HEMP, COIR, &c.

Rocket Lines and Whips for Life-Saving Apparatus.

SHROUD LAID ROPES MADE ANY LENGTH WITHOUT SPLICING.

Manilla Springs for Steel Hawsers.

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LOWESTOFT. GRIMSBY. YARMOUTH. LIVERPOOL.

Agents in Australia—

MELBOURNE—ADAMS & CO. SYDNEY—BALCHIN & JOHNSTON.

A HIGH-CLASS ANTI-CORROSIVE LUBRICANT.

"ENGELBERT'S LUBRICATOR,"

Price 3s. 9d. per Gallon.

DELIVERED CARRIAGE FREE IN THE UNITED KINGDOM,

FOR

CYLINDERS AND VALVES,

HEAVY BEARINGS, SHAFTING, HIGH SPEED MACHINERY, &c., &c.

CORROSION IMPOSSIBLE.

Cannot GUM or CLOG the Machinery.

Specially suitable for **MARINE ENGINES** because it has no Corrosive Action on Boiler Plates, and prevents "Scale" in Boilers when used in Engines having Surface Condensers, or fitted with Feed Heaters, in which the Exhaust Steam becomes mixed with the Feed Water.

PRESERVES THE INDIA-RUBBER VALVES.

Leaves no deposit in Boilers or Condenser Tubes.

M O Pale Amber-Coloured Compound M O

MACHINERY OIL,

FOR THE GENERAL LUBRICATION OF MARINE ENGINES,

AND FOR ALL PURPOSES *EXCEPT CYLINDERS,*

Price 2/9 per Gall. Quantities of 200 Gallons and upwards 2/6 per Gall.

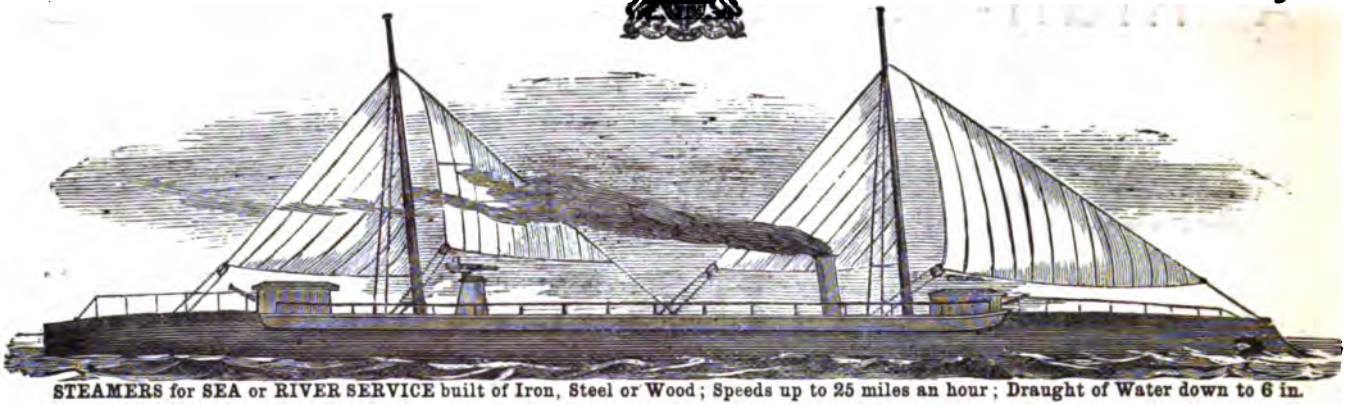
DELIVERED CARRIAGE PAID IN UNITED KINGDOM.

Particulars and Testimonials on Application to the Patentees and Sole Manufacturers—

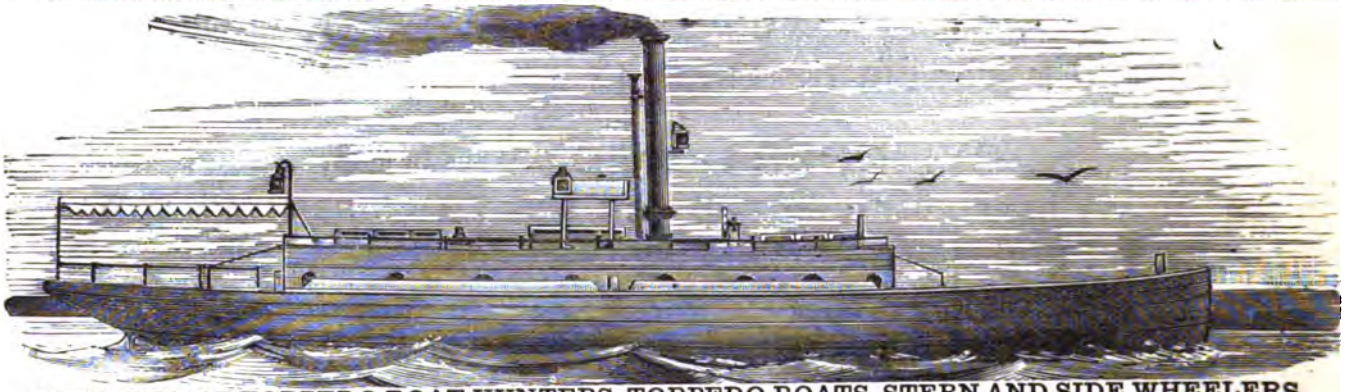
ENGELBERT & CO.,

70 AND 71, BISHOPSGATE STREET, LONDON, ENGLAND.

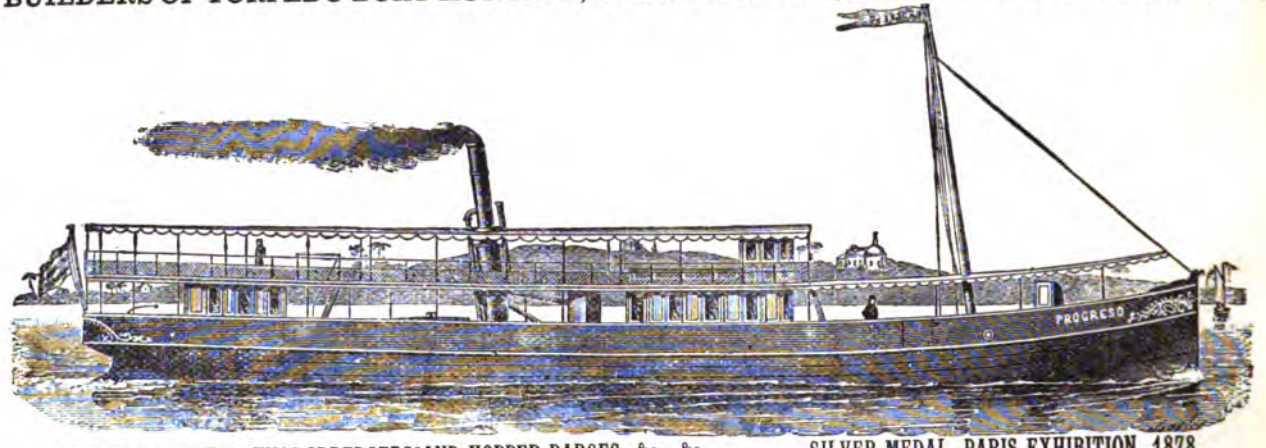
EDWARDS & SYMES,



STEAMERS for SEA or RIVER SERVICE built of Iron, Steel or Wood; Speeds up to 25 miles an hour; Draught of Water down to 6 in.



BUILDERS OF TORPEDO BOAT HUNTERS, TORPEDO BOATS, STERN AND SIDE WHEELERS.



YACHTS, LAUNCHES, TUGS, DREDGERS AND HOPPER BARGES, &c., &c. SILVER MEDAL, PARIS EXHIBITION, 1878.

CUBITT TOWN, LONDON, E.

Contractors to the Admiralty, H.M. Indian and Colonial Governments.